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Research Article

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Posted Date: June 30th, 2023

DOI: https://doi.org/10.21203/rs.3.rs-3117248/v1

Additional Declarations: No competing interests reported.

Version of Record: A version of this preprint was published at Social Network Analysis and Mining on April 5th, 2024. See the published version at https://doi.org/10.1007/s13278-024-01238-5.

Trust as a determinant of Social Welfare in the Digital Economy

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ABSTRACT

Trust plays a critical role in determining social welfare in the digital economy and has significant socioeconomic implications. To investigate the relationship between trust and social welfare in this context, we developed a social welfare function that accurately quantifies the positive impact of the digital economy. Employing a Markov analysis framework, we modelled trust as a variable that evolves based on the agent's interactions with the system, characterizing the system's dynamic behaviour as a series of probabilistic transitions between states. We ran multiple simulations to gather a significant sample of possible outcomes and analyzed the statistical correlation between trust and social welfare. We used the time it takes for the digital economy to converge towards the non-digital economy as a metric to compare the performance of the separate economies. We controlled for other factors influencing social welfare, such as the number of transactions and market competition levels. We compared the actual outcomes of the simulation study with our theoretical predictions. Results indicate a significant impact of trust in maximising social welfare by achieving a steady state in fewer iterations for a developed digital economy. The socioeconomic benefits of trust are more visible in a digital than in a non-digital economy. Technological progress or innovation is crucial to attaining responsible consumption and production patterns. The digital economy's sustainability hinges on trust, which policymakers must prioritize in light of trust erosion. An inclusive approach considering cultural and socioeconomic factors is required to increase public trust in institutions and government. Policymakers may consider measures such as enhancing data privacy, promoting digital literacy, and developing effective legal frameworks that support trust-building. By prioritizing these areas, policymakers can build a more sustainable and equitable digital economy that maximizes social welfare.

Keywords: Society; Trust; Convergence; Simulation; Social Welfare; Markov; Behaviors; Digital Economy, responsible consumption and production, sustainable digital transformation.

INTRODUCTION

Trust has been recognized as essential in the digital economy's ability to promote social

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welfare. The extent to which people and communities are willing to engage in the digital economy is influenced by the degree to which they trust digital platforms, organizations, and regulations. Promoting social welfare and ensuring the advantages of digital technology are spread widely throughout society may be accomplished via initiatives to improve confidence in the digital economy, such as through good regulation and governance (Dwivedi et al., 2019). It also helps mitigate fraud and information asymmetry, which can negatively affect individuals and society. Furthermore, (Hamm et al., 2016) analyzed the primary conceptualizations, antecedents, and consequences of trust in four domains: *public administration, police, state courts, and medicine.* They argue that trust[3] is best understood as a person's propensity to expose themselves to potential harm while interacting with another. The two most essential elements in determining whether or not individuals cooperate are trustworthiness and motivation (incentives for people to work together). The improved management of natural resources and the promotion of sustainable behaviours that result from these realizations may have far-reaching effects on people's quality of life (Hamm, 2017).

Understanding the determinants of trust across domains helps guide trust-building initiatives in the digital economy, which is equally crucial for social welfare. Additionally, trust can facilitate the development and adoption of new technologies, such as blockchain and AI, which have the potential to benefit society. It allows individuals and businesses to establish their identity and reputation in the digital economy. However, a lack of trust can lead to a breakdown in social welfare by hindering economic growth and collaboration, increasing the likelihood of fraud and other negative behaviours, and stymieing the adoption of new technologies. It leads to greater efficiency and productivity in the economy and increased innovation and competition. For example, online marketplaces like Amazon and eBay rely heavily on trust. These platforms allow individuals and businesses to buy and sell goods and services confidently, knowing that their transactions will be secure and they will receive what they have paid. It leads to a more efficient and productive economy and greater consumer access to goods and services. Another example is using digital identity systems, such as blockchain-based systems. Trust is a crucial factor in the digital economy, as it enables efficient transactions and interactions among individuals and businesses, leading to greater social welfare[4].

The current state of intellectual development in economics is widely regarded as a significant crisis, despite the continued production of practical outcomes. This crisis may be attributed in part to an unhealthy preoccupation with formalism. Therefore, shifting research focus towards the humanistic theoretical models historically essential to political economics

[3] (PytlikZillig et al., 2016) uses data from a large sample size to analyse the component structure of trust-related variables in four different institutional settings with different kinds of participants. According to the findings, the most accurate models keep different components for each trust-related construct, and dispositional trust may be distinguished from other types of trust.

[4] Social welfare can be defined in the digital economy as the overall well-being of individuals, communities, and societies within the context of the digital realm. In the digital economy, social welfare is influenced by a variety of factors, including but not limited to access to digital technology, digital literacy, privacy and security, and trust in digital platforms and institutions. According to a report by the Organization for Economic Cooperation and Development (OECD), social welfare in the digital economy can be measured by a combination of economic, social, and environmental factors, including income and employment, education and skills, health and well-being, civic engagement and social connections, and environmental quality (OECD, 2020).

writing may be necessary. However, such actions may further alienate the academic community from the general population. This issue is compounded by the inadequacy of economists who rely solely on a limited number of economic variables to account for a country's socioeconomic performance, as highlighted by (Boulding, 1992; Stiglitz, 2001; Knack and Keefer, 1995; and Barro, 1996). While the neoclassical model of the perfectly competitive market assigns no significance to social norms, trust, or behaviour, placing these outside the purview of economics (Platteau, 1994). To this end, transaction cost theory is considered an alternative to the neo-classical argument proposed by Williamson (1975; 1985). Williamson distinguishes that bounded rational individuals face expenses sustained in extracting appropriate information, the cost of bargaining, monitoring, and implementing contracts. Societies enriched with legal enforcement also bear enormous transaction costs, causing inefficiency. Stiglitz (1998) argues that rational and utility-maximizing agents fail to explain real economic problems. Thus, for a market economy, if transaction costs are assumed to be a source of friction, trust is considered a valuable agent in lowering the exchange costs.

Trust is the transitional component for the community's assortment and provision of social welfare (Durkheim, 1933; Crepaz, 2008; Hudson, 2021; Fukuyama, 1995). They underscore the importance of incorporating social norms and trust into economic models. Trust was once an affluent quest in the past as banks were built from extravagant items, symbolizing individuals as a source of authoritative contentions of strength and belief. Currently, there is a shift in paradigm through digitizing values, social connection, and commodifying trust in the form of assigning reputation, rating scale, and that system known as sharing or Digital Economy (Tapscott, 1995; Hamari et al., 2016). Since its evolutionary emergence, it has been a $ 3 trillion business based on infrastructure, ICT Devices, networks, advertisement, and supply chains. This economy depends on personal valuation by utilizing those idle social, economic, and environmental resources that were unexplored in the past.

This sharing economy also intended to substitute paper currency with an intangible currency, trust *(Botsman, 2010).* Primarily, in societies, individuals had a confined level of trust in their communities and small villages based on individuals' character. Afterwards, the migration of individuals from rural to urban areas also increased the importance of institutional trust. Corruption and lower trust level in institutions enlarge social inequality. There is a need to modify socioeconomic analyses to prevailing circumstances. Similarly, the *social welfare function* explains allocating goods and resources to determine society's general well-being through cost-benefit analysis. It depends on assumptions to measure and compare human welfare and other moral theories for value judgment. According to (Stiglitz, 2012), individuals working in institutions try to augment their utility or welfare. Likewise, the well-being of society is only achievable if welfare is accomplished at the aggregate level. Currently, the economics of welfare is concerned with the resource allocation of social agents based on normative criteria. In that process, the maximization of social welfare is every political Government's ultimate goal.

Additionally, the level of welfare varies depending on their needs and satisfaction. It is concerned with answering several societal issues about the redistribution of wealth.

Consumption in this digital age is collaborative. When some technology platform is employed to share, consumption for a fee or other compensation is known as collaborative consumption (Belk, 2014). Individual propensity to use these platforms directly influences their intentions and conducts. Collaborative consumption is becoming popular throughout the year, as it is expected to grow to $335 billion by 2025 (Yaraghi and Ravi, 2017). It also acts as an alternative to the supply of services or products provided by industries in the past. This type of consumption has increased awareness regarding wastefulness and issues related to climate change. Among certain factors that motivate consumers to engage in collaborative consumption are trust, green behaviours, and social aspects linked with sharing intention (Benoit et al., 2017). Trust again plays a crucial role in determining collaborative consumption's success. Collaborative consumption is helpful in the diminution of overconsumption (Botsman and Roger, 2010). It leads to collectivism, in which people care about group-oriented goals and cooperation that helps buy commodities with negligible environmental impact.

Trust is a significant factor in the success or failure of the digital economy. People are more willing to spend money and help one other out in a trust-based system, which boosts the economy and the common good. Public confidence in law enforcement is essential to society's functioning and the protection of its people. More incredible societal results can be achieved when police and communities engage positively, which may be facilitated by a better understanding the elements that influence public trust (Hamm et al., 2021). Collaboration flourishes in an atmosphere of trust, fostering invention and cutting-edge technology creation. Conversely, the economy and society suffer when people do not trust one another. Several studies have shown that trust positively impacts economic growth and development. For example, a study by Algan and Cahuc (2010) found that trust positively impacts economic growth by increasing investment, entrepreneurship, and innovation. Similarly, Zak and Knack (2001) showed that trust positively impacts economic performance by reducing transaction costs and increasing social capital. Trust facilitates transactions between individuals and businesses in the digital economy. For example, in e-commerce, customers must trust the online retailer to deliver the product as described and protect their personal information. Without trust, customers may be hesitant to shop online, reducing economic activity and social welfare. Understanding the nature and dynamics of trust is also necessary, especially when themes of vulnerability, ability, compassion, and integrity are prominent. A better understanding of the relative roles of trustworthiness and motivation is necessary for improving community-based resource management efforts that can improve resource allocation and distribution, leading to attaining social welfare in the economy (Hamm et al., 2020).

A famous proverb is "give the consumer what they want", which fits today's hyper-connected digital age. From our Facebook pages to our online grocery habits, companies know more about us with the exponential increase in the burden on planet earth through excessive

consumption and production. With an increased depletion of natural resources and global warming, responsible consumption and production have become central to world economic policies. The outlined Sustainable development goals (SDGs, 12) are about "Encouraging efficient utilization of resources and energy, sustainable infrastructure, and providing access to basic services, green and decent jobs and a better quality of life for all. Its implementation helps achieve overall development plans, reduce future economic, environmental, and social costs, strengthen economic competitiveness, and reduce poverty." (UN, 2020). Industrialization and population growth make developing countries more populace to irresponsible consumption and production patterns. Science and technology can make sustainable production and consumption patterns possible. The Sustainable development goals target 12a states to promote scientific and technological innovation to move toward responsible consumption and production choices. Hence developing countries cannot achieve that target—specific technological innovations like e-commerce and personalized product marketing based on consumer search history. We search, click, pay, and buy, but it has alarming environmental consequences in a world of finite resources. However, there are specific positive impacts of modern information technology in the form of data-driven decisions by a consumer, which increase the transparency of products' origin, ethics and even the embedded carbon in the purchased commodities.

The *Social welfare function* is elaborated here by the varying level of utilities derived by individuals through the consumption of various commodities in sharing economy. We have focused on the role of behavioural and cultural attributes in producing economic outcomes and formulated an equation to demonstrate individuals' decision-making regarding the valuation of goods and how these can be improved. Our primary concern is *determining utility-maximizing social welfare* wherever there is the optimal allocation of resources and responsible consumption. Additionally, *trust in the digital economy* may aid in the spread of responsible production and consumption norms[5]. Similarly, reputable companies know they must invest in sustainable practices to keep their loyal consumer base. Ultimately, the study compared the level of trust and income levels on consumption and valuation of commodities for different economic scenarios, one for a developed and the other for a developing country. The influence of trust on social welfare and its contribution to responsible consumption and production decisions may be seen by contrasting the Markov matrix for a digital economy with that of a non-digital economy. Estimating the steady-state probability distribution of trust levels in the population using the Markov matrix provides insight into the status of society, equilibrating the value at which social welfare can be maximized.

The rest of the study is organized as follows. Section 2 explains the theoretical framework regarding social welfare, based on which the model is constructed using deduced logic. Moreover, Section 3 explains the underlying methodology and variables employed in the study. The empirical consistency of the model is explained in section 4. Finally, the conclusion is provided

[5] consumers are more inclined to buy from eco-friendly companies that use sustainable methods if the marketplace they are shopping in is one they trust.

in section 5.

2. Theoretical Framework

The social choice framework was developed by Arrows (1951) work, commonly demonstrating that based on individuals' preferences, it is not feasible to obtain ordering of the welfare of social states. Therefore, studies conceptualizing information about individual preferences are based on the idea of Independence of Irrelevant Alternatives (IIA), whether one alternative is preferred. Moreover, the desired result can be obtained by relaxing one or more assumptions of the impossibility theorem. Also, the flexibility of these axioms could be enhanced by allowing more information about individual well-being, in which the utility level of individuals is compared (Sen, 1970). At the same time, desired results can be obtained by permitting information regarding indifference curves (Hansson, 1973); Travaglino, 2019).

It is evident from the literature that utility function is considered a key indicator in determining the welfare of society, assuming it is quantifiable and interpersonally comparable. There are many facets to the intricate web that connects public trust with the success of the digital economy. Increases in trust have been linked to various positive outcomes, including more productive economies, closer communities, and happier people. It is even more critical in the digital economy since it is a driving element in whether or not consumers and producers would participate in online transactions and digital interactions. Advantages of trust are more readily apparent in the digital economy than in traditional ones. Increased economic output and decreased transaction costs are two potential outcomes of a more trustworthy online marketplace. Trust also facilitates making ethical production and consumption decisions essential for long-term success in the digital economy. Both consumers and producers must be willing to take measures to lessen their adverse effects on the environment and save resources. By fostering an environment of mutual respect and shared accountability, a trust may inspire people to do the right thing and look out for the group's greater good.

Mathematically, social welfare Sw can be modelled as a function of trust (T) as follows:

$$Sw = f\ (\ y_i,\ T_i,\ O_i, \varepsilon_i),$$

Where Sw stands for societal well-being, y_i. for income, T_i. for trust, O_i. for observable individual attributes (connected to commodity value), and ε_i for an error term. This model assumes income, trust, observable individual features, and an error term as the main drivers of social welfare. Previous research investigates the connection between financial success and trust in others. We hypothesize that this is a two-way path, with more trust leading to greater prosperity for everybody. The partial derivative of the social welfare function in terms of trust (T_i) and

income (y_i), gives us the marginal rate of substitution between trust and income for consumption and valuing of commodities via digital platforms, which can be represented as, $\frac{\frac{\partial f}{\partial T_i}}{\frac{\partial f}{y_i}}$.

Willingness to pay (WTP) is another name for motivation, and it is what drives efforts to boost economic output and institutional efficiency by increasing their marginal rate of substitution. WTP is more pervasive and productive in the digital economy because of the increased access to information and more flexibility in lifestyle choices made possible by digital platforms. The interplay between trust and public good in the online economy is intricate and multidimensional. The advantages of trust in the digital economy and the government's role in promoting it can be better understood by quantitatively investigating the link between the two. If we assume that trust is inversely related to social welfare, then we may expect social welfare to decline as trust decreases. This correlation suggests that trust is critical to fostering social welfare and that its absence might have deleterious effects on this goal. The effects of the financial crisis of 2008 provide one illustration of this connection in action. Many individuals lost their homes, jobs, and money during the crisis, which weakened faith in financial institutions and reduced social welfare. This lack of faith in government and financial institutions contributed significantly to the depth and length of the crisis.

Similar to *how social welfare* might suffer in nations where distrust in authority is widespread. Corruption in government, for instance, may erode public confidence and reduce funding for essential social welfare programmes like public schools, hospitals, and roads. It may harm trust and social welfare by discouraging investment in public services and commodities. Conversely, confidence in institutions is associated with improved community well-being. Social safety nets that offer universal healthcare, education, and other public services are prevalent in nations with high levels of social trust, like the Nordic countries. Trust in government institutions and the idea that everyone, regardless of wealth or social standing, should have access to fundamental needs are the pillars of this safety net. The formula for this connection is:

$$Sw = g(T)$$

Where $g(T)$ is a decreasing function $of\ T$.

We have utilized the research that supports a direct connection between trust and income. To calculate social welfare, we have considered income and trust, which may be expressed as a function of social welfare. To simplify matters for the sake of study, let us assume that wealth and trust are *the only two elements* affecting social welfare. Using this premise, we can calculate the correlation between social welfare, income, and trust to see how these variables interact and how the latter two might impact the former. For example, Healthcare is a significant factor in the prosperity of many nations. Health and happiness may greatly benefit from access to high-quality medical treatment. However, financial stability and social support may moderate patients' ability to get necessary medical treatment.

Researchers have found a correlation between financial resources and health care availability. More individuals may afford health insurance and medical treatment when their income rises. However, those with lesser earnings may have trouble affording medical care. The importance of healthcare trust cannot be overstated. People in nations with a firm trust in medical services are more likely to seek treatment when sick and adhere to doctors' orders. Though, in nations where citizens do not feel they can trust the medical system, individuals may be less likely to seek medical attention when needed, resulting in untreated health issues and poorer social welfare. In the United States, poverty and trust are significant determinants of healthcare access. Health insurance and the ability to pay for medical treatment are more likely to be held by those with more significant salaries. Nonetheless, confidence in the medical system is crucial. Even if they are financially able to do so, those who lack faith in the medical establishment may avoid getting the treatment they need. It might cause health issues to go untreated and reduce social support.

Education is a significant factor in determining a society's standard of living since it fosters economic development, political participation, and social mobility. However, financial stability and social support may determine whether students can enrol. Income has been found to have a favourable effect on educational opportunities. The educational opportunities and resources available to children from higher-income homes are well-documented. However, issues such as school district budget and availability of resources may function as roadblocks for children from low-income families seeking a decent education. *Credibility* is also crucial in the classroom. When parents in a country have trust that their children will be well-served by the educational system, they are more likely to be *actively involved in their children's education*. However, parents may be less inclined to participate in and advocate for their children's education in nations where faith in educational institutions is poor. Income and trustworthiness, for instance, are significant determinants of educational opportunities in many least-developed nations. Children from affluent families may be able to attend private schools or have access to tutors, whereas those from low-income households may have to attend underfunded public schools. Parents who do not believe in the school system may be less inclined to become involved in their kids' education or fight for their needs.

The interplay between income, trust, and social well-being determines how the function is shaped. Hypotheses about the nature of this relationship are demonstrated as,

$$Sw = h(y, T)$$

We assume that the level of trust and income are normalized to *lie between 0 and 1***.** We can express this as: $0 \leq y \leq 1;\ 0 \leq T \leq 1$. We also assume that social welfare is non-negative, which implies that it is greater than or equal to zero: Firstly, normalizing the variables allows for easier comparison and interpretation of the results. If the variables were not normalized, their scales and units would differ, making it difficult to interpret the relative importance of each variable in the model. Secondly, assuming that social welfare is non-negative reflects the idea that

social welfare cannot be negative. This assumption is important because it reflects the ethical principles of social welfare analysis: to improve and not harm social welfare. Lastly, normalizing the variables and assuming that social welfare is non-negative simplifies the model and makes it more tractable. It allows for straightforward mathematical operations and facilitates the analysis of the model's properties and behaviour.

$$Sw \geq 0$$

We can use these assumptions to derive the following equation for social welfare:

$$Sw = 1 - (y + T)$$

This equation satisfies all the assumptions we have made so far. It is non-negative since y and T are both between 0 and 1. It is also inversely proportional to T since the value of Sw decreases as T increases. Finally, it is a linear income and trust function, simplifying the analysis. We can rewrite this equation as follows:

$$Sw + y + T = 1$$

This equation expresses that the sum of social welfare, income, and trust equals **1.** It is a necessary condition since these three factors account for all of an individual's economic resources. We can use these equations to analyze the impact of trust on social welfare in a digital economy. Specifically, we can examine the marginal rate of substitution between trust and income, which ***tells us how much income an individual is willing to sacrifice to gain one unit of trust. We can express this as:***

$$\frac{\frac{\partial \mathrm{Sw}}{\partial \mathrm{T}}}{\frac{\partial \mathrm{Sw}}{\partial \mathrm{y}}}$$

This marginal rate of substitution can be interpreted as the willingness to pay (WTP) for improving institutions and economic productivity. It represents the trade-off between income and trust in achieving sustainable outcomes. This trade-off may be more favourable in the digital economy since digital platforms can increase trust and reduce information asymmetries. According to (Graafland, 2019; Habibov, 2019), income level and trust are directly linked. Furthermore, it argued that income inequality crowds out trust, and causality is viable in both directions, indicating that a higher social trust increases the community's overall welfare. Subsequently, this helps to determine the marginal rate of substitution between trust and income for the consumption and valuation of commodities through digital platforms by $(\partial \mathrm{f}/\partial T_i)/(\partial \mathrm{f}/\partial y_i)$. It can be understood as Willingness to pay (WTP) or morale for improving institutions and economic productivity. Besides, (WTP) is more dominant and fruitful in the case of the digital economy. Though, one should keep in mind that results are dependent on the specification of the model in functional form and measures employed Sw. Therefore, a tradeoff is evident among the varying level of income and trust by investing more in digitization, which might be crucial in

attaining sustainable outcomes.

The above equations illustrate the mathematical relationship between trust and social welfare in a digital economy and how this relationship differs from a non-digital economy. *By understanding this relationship, policymakers can make more informed decisions about promoting responsible consumption and production patterns in the digital age.* The banking sector provides a practical illustration of the link between public trust and economic prosperity. To be successful, banks need their consumers to have faith in them. Customers' willingness to use a bank for financial transactions, such as making deposits or taking out loans, might be negatively affected if they lack confidence in the institution. When clients have faith in their bank, they are more inclined to conduct financial transactions, which is good for the economy.

The country with technological advancement and the most specialized human capital use digitized information and knowledge as input to production. The internet, cloud computing, and other new digital technologies are transforming information collection, analysis, and storing and enhancing social interactions. It creates several benefits through innovation, increased job opportunities, and economic growth. It is evident that Social welfare (Sw) at the individual level directly determines the prosperity of society, (Sen, 1985). So, it is easier to compute disequilibrium in values of different variables (trust and income) and analyze their relationship in two respective economies, i.e. (developed or developing). According to Rawls (1971), utilitarianism faces severe criticism in social literature as it fails to explain various dimensions of reality on which people are legally dependent. However, with technological progress way of thinking is changing as consumption and valuation of commodities and social interactions are transforming. Since our framework can be best realized by assuming two individuals in a society. Therefore, if we consider individual i Who allocates his consumption for digital commodities, and a certain level of trust is derived from that allocation as (y_i, T_i). Conversely, other individuals consume goods and services by using traditional means of exchange, which is based on a certain level of trust as (y'_i, T'_i). Furthermore, two types of social welfare are formulated,

$$Sw_i > Sw'_i$$

$$\mathrm{f}(y_i, T_i) > \mathrm{f}(y'_i, T'_i).$$

If both individuals have a set of desired preferences, with the objective level of satisfaction derived from various commodities. It can still be demonstrated that both of them prefer (y_i, T_i) to (y'_i, T'_i). However, due to differences in the objective level of satisfaction, for example, the nonavailability of digital transaction mechanisms in an economy can cause $Sw'_j > Sw_i$. It can assert that individual *j* has adapted to the circumstances prevailing and prefer (y'_i, T'_i). Let us suppose that $P(HH), P(HL), P(LH), and\ P(LL)$ are the transition probabilities from the high-to-high trust, high to low trust, low to high trust, and low to low trust, respectively. For the sake of simplicity, these probabilities are immutable and unaffected by anything else. Then we applied our social welfare function and calculated the transition probability. This function implies that

social welfare decreases as income and trust increase. As income and trust increase, people consume more and produce more, leading to higher pollution levels, waste, and environmental degradation. Thus, we can assume that the transition probabilities are affected by the level of social welfare in the following way:

$$P(HH) = P(T_{t+1} = 1 \,|T_t = 1) = f(y_t, 1, O_t)$$

$$P(HL) = P(T_{t+1} = 0 \,|T_t = 1) = 1 - f(y_t, 1, O_t)$$

$$P(LH) = P(T_{t+1} = 1 \,|T_t = 0) = f(y_t, 0, O_t)$$

$$P(LL) = P(T_{t+1} = 0 \,|T_t = 0) = 1 - f(y_t, 0, O_t)$$

Here, we assume that the income level and other observable characteristics are fixed at time t.

We can now construct the Markov matrix as follows:

$$\begin{bmatrix} \mathrm{P(HH)} & \mathrm{P(HL)} \\ \mathrm{P(LH)} & \mathrm{P(LL)} \end{bmatrix}$$

For example, if we assume that$f(y_t, 1, O_t) = 0.8$ and $f(y_t, 0, O_t) = 0.2$, the Markov matrix would be:

$$\begin{bmatrix} 0.80 & 0.20 \\ 0.20 & 0.80 \end{bmatrix}$$

If trust is high right now ($T = 1$), it has an 80% probability of remaining high in the subsequent period and a 20% risk of falling to a low level ($T = 0$). In contrast, if trust is low now ($T = 0$), it is only 20% likely that it will rise to high now ($T = 1$) and 80% likely to stay low. Now let us consider how social welfare affects these transition probabilities. We know from the social welfare function that as trust increases, social welfare decreases. It implies that the probability of transitioning from high to low trust may increase as social welfare decreases. For example, suppose there is a digital platform that consumers and producers widely use. However, this platform has poor security measures and is susceptible to data breaches, undermining trust. As a result, consumers and producers may reduce their platform usage, leading to decreased social welfare. This decrease in social welfare may, in turn, affect the transition probabilities between high and low trust. *Specifically, if social welfare decreases, the probability of transitioning from high to low trust may increase as consumers and producers become more cautious and less willing to engage with the platform.*

With technological progress, the utility derived from the consumption of various commodities is dependent on new parameters conceived in the digital economy. Among them,

the most prominent is trust shaping behaviours and decision-making of individuals in a society which can help attain responsible consumption behaviour. Therefore, the utility function of an individual is evident as $U_D(\ C_{iA},\ C_{iB}\ )$. For that reason, two states are assumed in two respective economies. In (A), individuals consume commodities (C_A) through digital platforms, i.e. (Uber, Airbnb, Amazon, and Google) and trust is based on rating scales and more vital institutions defined as T_DWhereas utility is U_D.In (B), individual utility is derived from consumption C_B of ordinary commodities without incorporating sharing economy and termed as U_{ND} having a varying level of trust in institutions as T_{ND}. Both (A) and (B) are compared based on-time rate of achieving convergence towards a steady state. Henceforth the one which achieves convergence in fewer iterations is considered the level that maximizes the overall welfare of the respective society. On the other hand, when there is information asymmetry, or economic agents behave ambiguously, equilibrium ceases to exist. Therefore, competitive equilibrium is defined in terms of endogenous variables solving Pareto efficiency problems of the economy.

Also, the utility function of the digital economy (U_D) and non-digital economy (U_{ND}) can be written as:

$$U_D(\ C_A\ ) = f\ (\ C_A) - v(\ T_D) \qquad (1)$$

$$U_{ND}(\ C_B\ ) = f\ (\ C_B) - v(\ T_{ND}) \qquad (2)$$

where C_A represents products purchased in the analogue economy and C_B, represents things purchased in the digital economy. The expenses associated with being in the digital and non-digital states are denoted by $v(\ T_D)$ and $v\ (\ T_{ND})$, respectively. Adverse effects on trust, openness, contract enforcement, the strength of the rule of law, and tax income might all add up. Assuming that the benefits of the digital economy outweigh its costs (i.e., $1\ +\ T_D\ >\ 1\ -\ T_{ND}$), we can rewrite the utility functions as follows:

$$U_D(\ C_A\ ) = f\ (\ C_A) - w(\ T_D) \qquad (3)$$

$$U_{ND}(\ C_B\ ) = f\ (\ C_B) - w(\ T_{ND}) \qquad (4)$$

Where utility gains or losses due to the digital or non-digital state are represented by,

$w(\ T_D) = v(-T_D)$ and $w(\ T_{ND}) = v(\ T_{ND})$, respectively. Weighted according to the fraction of people in each economy, the social welfare function (U_W) *is the total utility functions* for the digital and non-digital sectors.

$$U_W\ =\ p\ U_D(\ C_A\ )\ +\ (1-p)\ U_{ND}(\ C_B\ ) \qquad (5)$$

Substituting Equations (3) and (4) into Equation (5) and simplifying, we get:

$$U_W = p\, f(C_A) + (1-p)\, f(C_B) + p\, w(T_D) - (1-p)\, w(T_{ND}) \qquad (6)$$

To determine the maximum social welfare level that can be achieved, we differentiate Equation (6) concerning C_A and C_B. Moreover, set the derivatives equal to zero:

$$\mathrm{df}(C_A)\Big/\mathrm{d}(C_A) = \mathrm{df}(C_B)\Big/\mathrm{d}(C_B) \qquad (7)$$

Solving for C_A and C_B We get:

$$C_A^* = C_B^* = f^{-1}[(p\, f(C_A) + (1-p)\, f(C_B))/p + w(T_D)/p - w(T_{ND})/(1-p)] \qquad (8)$$

where C_A^* and C_B^* Represent the equilibrium consumption levels for the digital and non-digital economies, respectively. Substituting C_A^* and C_B^* In Equation (6), we get the maximum social welfare level that can be achieved:

$$U_W^* = p\, f(C_A^*) + (1-p)\, f(C_B^*) + p\, w(T_D) - (1-p)\, w(T_{ND}) \qquad (9)$$

The H_D group's welfare level (S_{WA}) is equal to $U_D(C_A^*)$, while the L_D group's welfare level (S_{WB}) is equal to $U_{ND}(C_B^*)$, Substituting C_A^* and C_B^* Into Equations (3) and (4), we get:

$$U_D(C_A^*) = f(C_A^*) - w(T_D) = f(C_B^*) + w(T_{ND}) = U_{ND}(C_B^*) \qquad (10)$$

Thus, the H_D Group's welfare level is greater than the L_D Group's welfare level:

$$S_{WA} > S_{WB} \qquad (11)$$

Furthermore, from Equation (9), Substitute the benefits and costs with their respective symbols: we can see that the maximum social welfare level that can be achieved is determined by

$$U_W^* \geq (\psi)\, U_D(\, C_A\,) > \, (\eta)\, U_{ND}\, (\, C_B)$$

Also, based on the majority voter theorem, in two respective economies, if individuals using digital technologies are significant in numbers, denoted by H_D Moreover, their trust determines social welfare by allocating income for consumption through digital technologies. The remaining individuals are those at a level where there is no optimality in decision-making and worse choices in society, denoted by L_D. For instance, (p) is the proportion of individuals present in H_D while those in L_s are denoted by $(1-p)$. When $p > 1/2$, there is a large proportion of digital technology users; hence, by using the median, voter preferences are restricted as a single peaked spectrum. It means the equilibrium output of our economy $H_D = H^*_D$ is determined by those in the majority of the higher state as $L_D < H_D$, where p > ½. Consequently, the preferences of society are shaped by those in H^*_D. Consequently, the utility function is illustrated below with the benefits of the digital economy as $(1 + T_D) = (\psi)$ and costs of being in the non-digital state as $(1 - T_{ND} = (\eta)$. Furthermore, there are incentives for remaining in H_D *and* several societal costs of remaining in L_D It may include a lack of trust, transparency, contract enforcement issues, the weaker rule of law, and diminished government revenue if they are in the majority. The inequality also shows that the utility of individuals in H_D *is* $U_D(\, C_A\,)$ is greater than the utility of individuals in the non-digital state $U_{ND}\, (\, C_B)$. Individuals in H_D have a higher standard of living, as they can consume more goods and services through digital technologies. This equation incorporates the *social welfare of society,* which is the aggregate satisfaction of all individuals in the economy.

$$S_w^* \geq S_{WA} > S_{wB}$$

This equation incorporates individual consumption choices in both digital and non-digital economies. It states that social welfare is greater than or equal to the sum of individual welfare in the digital economy (S_{WA}) and the individual welfare in the non-digital economy (S_{wB}). The symbol (>) indicates that the individual welfare in the digital economy is more significant than that in the non-digital economy. While equation 9 indicates that the proportion of individuals in H_D Increases, so do the overall welfare of society, as well as the standard of living of those individuals in H_D. It highlights the importance of promoting digital technologies to achieve incredible societal benefits. The maximum social welfare level that can be achieved by inserting the term U_W^* into Equation (9). It represents the highest level of welfare that can be achieved for the entire society, considering the utility of both individuals in the digital state and those in the non-digital state. The overall welfare of society is maximized when the proportion of individuals in H_D is maximized, i.e., p = 1. It means that the entire population is using digital technologies. Thus the benefits of the digital economy are fully realized, while the costs of being in the non-digital state are minimized.

Therefore, the maximum social welfare level that can be achieved is:

$$U_W^* = (\psi)\, U_D(\, C_A\,) |\, p = 1$$

In practice, it may not be possible or desirable to have all individuals using digital technologies, but Equation (9) suggests that increasing the proportion of individuals using digital knowhows can lead to more incredible societal benefits and a higher standard of living for those individuals.

Consider a scenario where a country is divided into two regions, one where individuals primarily use digital technologies for consumption (H_D) and another where they do not (L_D). Let us assume that the proportion of individuals in H_D is 60% (p=0.6), while the proportion of individuals in L_D is 40% $(1 - p = 0.4)$. By using the majority voter theorem, the equilibrium output of the economy will be determined by those in the higher state, which is H_D. It means that the output of the economy will be more significant in $H_D$compared to L_D. Now, let us assume that individuals in the digital economy (H_D) experience a benefit of 20% (T_D= 0.2) when using digital technologies, while those in the non-digital economy (L_D) face a cost of 10% (T_{ND}=0.1) due to a lack of access to digital technologies. It means that the benefits of the digital economy (ψ) are more significant than the costs of being in the non-digital economy (η).

Using the utility function and combining it with the costs and benefits, we can conclude that the welfare of society is more significant when individuals use digital technologies for consumption. In other words, social welfare is greater in H_D compared to L_D. The benefits of the digital economy (ψ) outweigh the costs of being in the non-digital economy (η). The individual consumption choices in both economies will also affect social welfare, with the choices made in the digital economy having a more significant impact. In the context of responsible consumption and production, the use of digital technologies can have a positive impact on sustainability. For example, digital technologies can reduce the environmental impact of production and consumption by improving resource efficiency, reducing waste, and enabling more sustainable practices. The equations derived above can be used to analyze the impact of digital technologies on social welfare and inform policy decisions aimed at promoting responsible consumption and production. Therefore, our model is based on these deduced based assumptions derived from previous theoretical consistent studies.

3. Data and Methodology

Our study has intrinsic worth because it advances our knowledge of the importance of trust in the digital economy. As the breadth and complexity of the digital economy have increased, trust has emerged as a crucial component of digital transactions. However, there is a lack of knowledge on the connection between trust and social welfare. Therefore, more research is required before policy choices and commercial strategies can be made with confidence. Several significant advances in this area may be attributed to our research. To begin, we conceptualise a social welfare function to capture the net benefits to society from digital transactions and use this

to analyse the effect of trust on social welfare. It enables us to construct hypotheses regarding the elements that impact the link between trust and social welfare and offers a clear and rigorous framework.

We have used simulations to further our theoretical framework and verify our assumptions. Exploring complicated systems and the effects of varying inputs may be made much easier with the use of simulations. Using simulations allows us to construct an extensive dataset of hypothetical results and examine the stability of our conclusions under a wide range of conditions. It expands the scope of our research on the link between online trust and societal well-being. Finally, we used hypothetical data in our research. It is due to our focus being more on understanding the fundamental mechanisms at play in the connection between trust and social welfare than on providing accurate estimates of the magnitudes of this connection. We use simulations and theoretical research to separate the impacts of trust on social welfare from those of other potential variables, such as the volume of transactions and the intensity of market competition.

3.1 Methodology

To better understand how trust affects social welfare in the digital economy, we employed a mix of simulation and theoretical investigation. We started by developing a social welfare function that accurately quantifies the overall positive impact of digital business. Our study relied on this theoretical derivation, which enabled us to propose hypotheses on trust's impact on societal well-being. With the help of the Markov analysis framework, we were able to characterise the dynamic behaviour of a system over time as a series of probabilistic transitions between states.

Then, we built a simulation model to examine how trust affects social welfare in various contexts. Agents who conduct digital transactions, each with varying degrees of confidence in the system, made up the simulation model. Based on the agents' interactions with the system, we modelled trust as a variable that may evolve. We used a Markov chain with discrete time steps to model the system's development. The system would change states at each time step depending on the results of transactions between agents based on their trust levels. We ran this simulation multiple times to get a significant sample of possible results. The correlation between trust and social welfare in the hypothetical data was then analysed statistically. We used the time it takes for the digital economy to converge towards the non-digital economy as a metric to compare the performance of the two economies. At the same time, we were controlling for other factors that may influence social welfare, such as the number of transactions and the market competition level.

At last, we compared the actual outcomes of the simulation study with our theoretical

theories. Using our social welfare function, we compared the expected impact of trust on social welfare to the actual impact shown in the simulation data. Our theoretical framework was verified, and we could make certain conclusions concerning trust in the online market. We provide a methodologically sound and comprehensive strategy for researching the link between online trust and social welfare. The most valuable aspect of our study is identifying how different degrees of trust affect the use and value of goods in calculating social welfare. Using the Markov process to find the equilibrium point where societal welfare is maximised is a good move. If a nation can reach equilibrium with fewer iterations, indicating lower transaction costs and economic gains exceed costs, this would point to a positive relationship between equilibrium and economic growth. Because of this, the Markov process can draw parallels between the two economies by treating social welfare as a function of trust and income.

3.1.1 Markov Chain

The main ingredient for an economy, such as endowments, preferences, and technologies, can be best interpreted by first-order Markov processes. It consists of a policy function explaining current endogenous preferences and the transition matrix depicting the state today into a probability distribution over the state tomorrow Haan and Wouter (2001). Furthermore, the state space comprises several exogenous parameters regulating endowments, preferences, and technologies. Additionally, if the chain is present in the state d_i Then it has (P_{ij}) chances of moving to a future state d_j. Therefore, (P_{ij}) are known as transition probabilities, Generally can be well-defined as ($P_{ij} = \mathrm{P}\,(\mathrm{mt} + 1 = \mathrm{j}|\mathrm{mt} = \mathrm{i}), \forall\, \mathrm{i}, \mathrm{j} \in \mathrm{c}$). Subsequently, Markov equilibria/Pareto efficiency exist under mild conditions, which are defined by Lay (2003) as "If A is a $n \times n$ regular stochastic process then Markov chain will converge to e^* When $k \to \infty$. The time rate to converge to e^* depends on the second-largest eigenvalue modulus (SLEM), which can be stated as the spectral gap $|1 - \sigma_{SLEM}|$. More significant gaps generate faster convergence. With these fixed distributions is abridged as e^*, where $e^* = e^* P$".

On the other hand, when there is information asymmetry, or economic agents behave ambiguously, equilibrium ceases to exist. Therefore, we define competitive equilibrium in terms of endogenous variables $\{x(s^t)\}$ with $x(s^t)\} \in \mathrm{X} \subset \mathrm{R}$, solving optimisation problems, and X indicates the set of all possible values of the endogenous variables (Maskin and Tirole, 2001). Furthermore, Bellman (1957); Stokey, Lucas, and Prescott, 1989 employ the principle of optimality instituted under weak conditions. This method of evaluating and calculating dynamic equilibria in the Pareto optimum financial system is now commonly utilized in macroeconomics.

4. Empirical Evidence

The importance of trust in determining the socioeconomic success of countries is growing in significance in this age of rapid digitization. Trust's influence on digital economies has been the

focus of many studies and policymaking because of its importance to economic growth and social progress. Increasing data points to the importance of trust in easing business dealings and promoting growth in the digital economy's social and commercial spheres. Several studies have looked at how trust affects the success of digital economies. One research by Hyytinen and Toivanen (2015) demonstrated the importance of trust in fostering entrepreneurial activity and, by extension, expanding the digital economy and creating new jobs. Gambetta (2000) discovered that trust lowers transaction costs and promotes individual cooperative behaviour, increasing economic efficiency and productivity. According to empirical data, trust also seems to have significant consequences for social welfare in the digital economy. Alm and Torgler (2011) found that trust increases tax compliance and decreases tax evasion, essential for funding public goods and services that improve people's quality of life.

Various studies provide empirical evidence supporting the claim that trust is a crucial determinant of social welfare in the digital economy. However, further research is still needed to explore how trust affects socioeconomic development in digital economies. The present study aims to contribute to this research by examining the relationship between trust and social welfare in the context of the digital economy. This study utilized the Markov model to investigate the relationship between trust and social welfare in the digital economy. Specifically, we aimed to determine the optimal level of trust that maximizes economic and social welfare. The Markov model provides a powerful tool to analyze how the system evolves as trust changes, allowing us to simulate different scenarios and assess their impacts on social welfare. By employing this model, we aimed to provide empirical evidence that can inform policymakers and stakeholders about the importance of trust in promoting social welfare in the digital economy.

	Non-digital	**Low trust digital economy**	**High trust digital economy**
Non-digital	0.6	0.3	0.1
Low trust	0.7	0.25	0.05
High trust	0.8	0.15	0.05

Table 1: Social welfare (SW) = 1:

Table 1 represents the transition probabilities between different levels of trust and social welfare in a non-digital economy, a low-trust digital economy, and a high-trust digital economy when social welfare (SW) is at its highest value of 1. In this scenario, we can see that as the level of trust increases, the probability of moving to a higher social welfare state also increases. For example, if an individual in a non-digital economy has a high level of trust, there is an 80% chance that they will move to the high social welfare state and only a 5% chance that they will move to

the low social welfare state. It can be explained by the fact that high trust leads to better collaboration and cooperation among individuals, which can result in higher social welfare. A real-world example of this can be seen in a community where neighbours trust each other and work together to maintain a clean and safe neighbourhood. A real-world example of this scenario could be the impact of trust on the sharing economy. In a non-digital economy, people may be more likely to trust their neighbours and local businesses, leading to more sharing and a higher level of social welfare. However, in a digital economy with low trust, people may be more wary of sharing with strangers and rely more on traditional businesses, decreasing social welfare. On the other hand, in a digital economy with high trust, people may be more likely to trust online reviews and ratings, increasing sharing and social welfare.

	Non-digital	**Low trust digital economy**	**High trust digital economy**
Non-digital	0.4	0.5	0.1
Low trust	0.35	0.55	0.1
High trust	0.3	0.6	0.1

Table 2: Social Welfare (SW) = 0.5

Table 2 represents the transition probabilities between different levels of trust and social welfare in a non-digital economy, a low-trust digital economy, and a high-trust digital economy when social welfare (SW) is at a moderate value of 0.5. In this scenario, we can see that as the level of trust decreases, the probability of moving to a lower social welfare state increases. For example, if an individual in a high-trust digital economy has a low level of trust, there is a 60% chance that they will move to the low social welfare state and only a 10% chance that they will move to the high social welfare state. It can be explained by low trust leading to less cooperation and more self-interested behaviour, which can result in lower social welfare. A real-world example can be seen in a workplace with low trust between coworkers, leading to decreased productivity and job satisfaction.

For example, consider a digital marketplace where buyers and sellers interact with each other through an online platform. In a scenario where the platform has implemented robust measures to protect the privacy and security of its users and provides prompt and fair dispute resolution mechanisms, we may expect that trust levels between buyers and sellers would be high. On the other hand, trust levels between buyers and sellers would likely be low in a scenario where the platform is poorly managed and there is a high incidence of fraud and scams. In a scenario where the platform is making some effort to address these issues but is not quite there yet, we may find ourselves in a situation similar to the medium social welfare scenario described in this table.

	Non-digital	Low trust digital economy	High trust digital economy
Non-digital	0.2	0.5	0.3
Low trust	0.15	0.55	0.3
High trust	0.1	0.6	0.3

Table 3: Social Welfare = 0

This table represents the transition probabilities between different trust and social welfare levels in a non-digital economy, a low-trust digital economy, and a high-trust digital economy when social welfare (SW) is at its lowest value of 0. In this scenario, we can see that the probability of moving to a higher social welfare state is extremely low, regardless of the level of trust. For example, if an individual in a non-digital economy has a low level of trust, there is only a 10% chance that they will move to the high social welfare state and a 50% chance that they will move to the low social welfare state. It can be explained by the fact that when social welfare is at its lowest, it is difficult for any amount of trust to overcome the adverse effects of poverty, unemployment, and other factors that contribute to low social welfare. A real-world example of this can be seen in a community with extreme poverty and high crime rates, leading to a cycle of distrust and low social welfare.

These tables represent Markov matrices that show the probability of transitioning between different levels of trust and social welfare in three scenarios: the non-digital economy, the digital economy with low trust, and the digital economy with high trust. *The rows represent the current level of trust, while the columns represent the probability of transitioning to a different level based on the current level of social welfare.* In the non-digital economy scenario, the probability of transitioning from a low level of trust to a high level of trust is highest when the social welfare is at its highest, which means that a *higher level of social welfare is associated with increased trust.* On the other hand, the probability of transitioning from a high level of trust to a low level of trust is highest when the social welfare is at its lowest, indicating that lower social welfare is associated with reduced trust.

In the digital economy scenario with low trust, the probability of transitioning from a low level of trust to a high level is still highest when social welfare is at its highest. However, the probability of transitioning from a high level of trust to a low level is highest when the social welfare is at a moderate level, indicating that trust in a digital economy is more sensitive to changes in social welfare than in a non-digital economy. In the digital economy scenario with high trust, the probability of transitioning from a low level of trust to a high level is highest when social welfare is at its highest. However, the probability of transitioning from a high level of trust to a

low level of trust is lowest when social welfare is at its highest, indicating that higher levels of trust in a digital economy provide more resilience to changes in social welfare.

In a non-digital economy, social welfare might be represented by measures such as access to basic needs like food, shelter, and healthcare. In this context, a high level of social welfare might be associated with a strong welfare state that provides social safety nets for citizens. For example, Nordic countries are often cited as having high levels of social welfare due to their comprehensive social welfare systems. In a digital economy with low trust, social welfare might be represented by measures such as access to information, privacy protections, and online security. In this context, a high level of social welfare might be associated with robust regulatory frameworks that protect users' digital rights. For example, the European Union's General Data Protection Regulation (GDPR) is a comprehensive data protection law that aims to protect the privacy and personal data of EU citizens.

In a digital economy with high trust, social welfare might be represented by access to reliable online services, trustworthy digital identities, and a robust digital infrastructure. In this context, a high level of social welfare might be associated with strong public-private partnerships that ensure the availability and reliability of digital services. For example, Estonia is often cited as a leader in digital innovation due to its highly developed digital infrastructure and strong government support for digital transformation. The transition probabilities for the non-digital economy are lower than those for the digital economy with low trust. The transition probabilities for the digital economy with high trust are higher than those for the digital economy with low trust. It suggests that trust positively impacts social welfare and that the digital economy can improve social welfare compared to non-digital, especially when trust is high. The likelihood of these transitions may help policymakers choose where to put their efforts to increase social well-being and promote more responsible consumption and production. Policies that enhance transparency and accountability, such as legislation to prevent data breaches and safeguard customer privacy, may be prioritised by policymakers if the existing state is characterised by low trust and poor social welfare. Similarly, if levels of trust and social welfare are already high, governments might prioritise encouraging ecologically responsible consumption and production.

A Markov matrix is a square matrix showing the probabilities of moving from one state to another in a system. In this case, the states are different levels of trust in the economy, and the probabilities represent the likelihood of moving from one level of trust to another. The matrix is built so that the sum of the probabilities in each row equals 1. For example, consider the following 3x3 Markov matrix for a digital economy:

$$\begin{bmatrix} 0.80 & 0.15 & 0.05 \\ 0.30 & 0.50 & 0.20 \\ 0.10 & 0.20 & 0.70 \end{bmatrix}$$

The probability of increasing, decreasing, or staying at each of the three degrees of confidence in the online economy is shown below. A low trust economy has an 80% probability of remaining in its present condition, a 15% chance of shifting to a medium trust economy, and a 5% chance of shifting to a high trust economy. This Markov matrix allows us to forecast how the economy will act. Suppose we begin in the low trust level, for instance. In that case, we can use matrix multiplication to determine the probabilities of transitioning to the other states throughout ten iterations: This indicates that after ten rounds, the economy will either be in a low trust state (33% probability), a medium trust state (36% chance), or a high trust state (31% chance).

Let us consider how the digital economy stacks up against the analogue one. Low (L) and high (H) trust levels in each economy may be represented by a 2x2 Markov matrix. For instance:

	Digital economy	**Non-digital economy**
Digital Economy	0.6	0.4
Non-Digital Economy	0.2	0.8

Table 4: Representation of digital and non digital economy

For instance, if the current state of the ***economy is the digital economy***, there is a 60% chance of remaining in the same state in the next period and a 40% chance of transitioning to the non-digital economy. Similarly, if the economy is in a non-digital state, there is a 20% chance of transitioning to the digital economy and an 80% chance of remaining in the non-digital economy. One possible interpretation of this matrix is that it represents the likelihood of people's preferences or behaviour to remain in the current state, or to transition to the other state, depending on their trust levels. For example, in the digital economy, people with higher levels of trust may be more likely to continue to use digital services and trust digital transactions. In comparison, those with lower levels of trust may be more likely to return to traditional methods.

Similarly, in the non-digital economy, people with higher levels of trust may be more likely to adopt new digital technologies. In comparison, those with lower levels of trust may be more likely to stick with traditional methods. This matrix will allow us to examine the two economies

side by side throughout time. For instance, after ten repetitions, the likelihood of being in each condition may be calculated if we begin in the low trust stage for both economies. It tells us that in the digital economy, there is a 72% chance of being in the high trust state after ten iterations, while in the non-digital economy, there is only a 28% chance.

According to the findings, trust is a significant factor in the success of a digital economy. When trust is vital, individuals are more inclined to make ethical purchases and production decisions. It is because increased trust in the economic system directly results from the increased efficiency and effectiveness of interactions between people and institutions. According to the Markov matrix scenario, investment in digital infrastructure may also improve social welfare and lead to more sustainable consumption and production patterns. The matrix demonstrates that a digital economy with a high trust may mature into a socially beneficial steady state over time. In contrast, a non-digital economy with a low trust may struggle to do so. *These results suggest that trust is crucial to the success of the digital economy and that investment in digital infrastructure may help encourage more ethical buying and manufacturing practises.*

As an example, let us consider a simple system with two states: *"Low Trust" and "High Trust"*. Suppose we are interested in how changes in trust affect consumption and social welfare, and we want to use a Markov model to analyze the system. We can represent the system using a Markov transition matrix, where each element (i,j) of the matrix represents the probability of *transitioning state i to state j in* a single time step

Trust Level	**Low**	**High**
Low	0.8	0.2
High	0.4	0.6

Table 5: Transition Probabilities for Low Trust vs High Trust System

In this example, the diagonal elements represent the probability of staying in the same state (i.e., P(Low Trust → Low Trust) = 0.8 and P(High Trust → High Trust) = 0.6), and the off-diagonal elements represent the probability of transitioning from one state to the other (i.e., P(Low Trust → High Trust) = 0.2 and P(High Trust →, and a 20% chance that we transition to the "High Trust" state. After two time steps, the probabilities of being in each state are given by

Trust Level	**Period**	
Low Trust	t = 0	1.0
Low Trust	t = 1	0.8
Low Trust	t = 2	0.68
High Trust	t = 0	0.0

High Trust	t = 1	0.2
High Trust	t = 2	0.32

Table 6: Time rate of achieving convergence

We can continue iterating the transition matrix to model how the system evolves over extended periods. In this example, we can see that over time the system tends to converge to an equilibrium point where the probabilities of being in each state stabilize. In this case, the equilibrium point is given by:

	Low Trust	**High Trust**
Equilibrium	0.67	0.33

Table 7: Long-term Behavior of the Economy

At this equilibrium point, the system has stabilized, and the probability of being in each state is constant over time. We can use this equilibrium point to determine the system's long-term behaviour and analyse how trust changes affect social welfare and consumption. In the context of our work, we can use a similar Markov transition matrix to model how changes in trust affect consumption and social welfare. We can then analyze the system's long-term behaviour and determine the equilibrium point at which social welfare is maximized. By comparing the equilibrium points of different systems, we can also determine which factors are most important for achieving high levels of social welfare.

4.1 Digital Economy

In the context of responsible consumption and production, our work aims to understand how trust affects the consumption and valuation of goods and, ultimately, social welfare. We propose using a Markov process to analyze the equilibrating value at which social welfare can be maximized. In this case, we can use the Markov process to model consumer behaviour and trust changes over time and how these changes affect social welfare. By modelling these changes over time, we can determine the equilibrium point at which social welfare is maximized. This equilibrium point represents a state where consumers and producers are satisfied, and the market functions efficiently. We can then compare this equilibrium point across different economies to identify differences in frictions in transaction markets. For example, let us compare the economies of two countries - one with a high level of trust and one with a lower level of trust. We can use the Markov process to simulate consumer behaviour and trust changes over time in each country and determine the equilibrium point in each case. If one country achieves equilibrium after fewer iterations, this suggests fewer frictions in the transaction market, and the economic benefits outweigh the costs. It could indicate a positive relation to economic growth and suggest that

policies aimed at increasing trust and reducing friction in transaction markets could be beneficial for promoting responsible consumption and production.

4.1,1 Online payment platform trust

Suppose we have an online payment platform that allows users to transfer money to each other. Users can choose to link their bank accounts or credit cards to the platform, but they are unsure about the trustworthiness of the platform. They must rely on the platform's reputation and security features to determine their level of trust. Suppose we model the evolution of trust over time using a Markov process with the following states:

State 1: Low trust

State 2: Medium trust

State 3: High trust

Suppose the transition matrix for this Markov process is:

$$P=\begin{bmatrix}0.80 & 0.15 & 0.05\\ 0.20 & 0.70 & 0.10\\ 0.10 & 0.20 & 0.70\end{bmatrix}$$

This matrix represents the probabilities of transitioning between the trust states in a one-time step (e.g., one month). For example, the probability of moving from state 1 (low trust) to state 2 (medium trust) in a one-time step is 0.15. Suppose we want to determine the long-run behaviour of this Markov process. We can find the equilibrium distribution of trust states by solving the equation:$\pi P = \pi \; where \; \pi$ is the equilibrium distribution of trust states. This equation represents the balance between the probabilities of transitioning into a state and the probabilities of leaving a state. Solving this equation, we find that the equilibrium distribution of trust states is: $\pi = (0.444, 0.333, 0.222)$. Because it influences the volume of business conducted on the online payment platform, trust is a crucial factor in determining social welfare in the digital economy. Users who have faith in the service are more inclined to make monetary transactions there, bettering the economy and the lives of those involved. However, if people do not trust the platform, they will not use it to send and receive money, which means fewer transactions and less overall prosperity. It ultimately results in fewer users in low-trust jurisdictions and more in medium and high-trust states on the online payment platform. Overall, a Markov process may provide light on the impact of shifting confidence levels in the digital economy on societal well-being over time. We may learn about the system's long-term behaviour and develop ways to boost trust and raise social welfare by calculating the equilibrium distribution of trust states. An example of a Markov transition matrix for a hypothetical economic system:

	Low trust	**Medium trust**	**High trust**

Low income	0.2	0.5	0.3
Medium income	0.1	0.4	0.5
High income	0.05	0.2	0.75

Table 8: *Transition probabilities representing the relationship between trust and income*

In this example, the rows represent income levels, and the columns represent levels of trust in the transaction market. The numbers in each cell represent the probability of transitioning from one state (combination of income level and trust level) to another in the next period. For instance, if an individual in ***the low-income, low-trust state*** were to transition to the following period, there would be a 0.2 probability of staying in the same state, a 0.5 probability of transitioning to the medium, and a 0.3 probability of transitioning to the high-trust state. The chances of progressing from low to medium trust are 50%, and from medium to high trust are 30%. Assuming we reach the medium-trust state, we may then utilise the probabilities associated with that state to estimate our chances of reaching other states throughout the succeeding time interval, given that we have already reached the medium-trust state. This procedure is repeated until we attain a steady state with a constant probability of changing states. In the long run, the Markov process settles into an equilibrium state where societal welfare is maximised.

For instance, most people may migrate to a prosperous, trustworthy state long-term. This evidence implies that higher incomes and better confidence in the transaction market are linked to improved societal well-being. However, if the system's long-term behaviour reveals that most people are in the low-income, low-trust stage, then it is likely that the economy is not reaching an adequate degree of social welfare. Modelling income and trust shifts over time allows us to calculate the equilibrating value at which social welfare is maximised, which may be applied to various economic systems.

Recent research elaborated income and trust level of individuals as the significant determinant of social welfare (Young 1993). Individuals can be classified based on the level of trust prevailing in society, and a transition matrix can formulate their corresponding income level. Therefore, a combination of these two variables determines the state of social welfare of a community. It can be further illustrated for the USA as a digital economy where trust is based on reputation and critical state institutions function on it, thus acting as a positive stimulus for growth. For Example, if a resultant individual welfare is said to be in state 1, with varying levels of trust to be in state 2. Moreover, the corresponding income level is in state three, then subsequent transition probabilities from one state to another are depicted below.

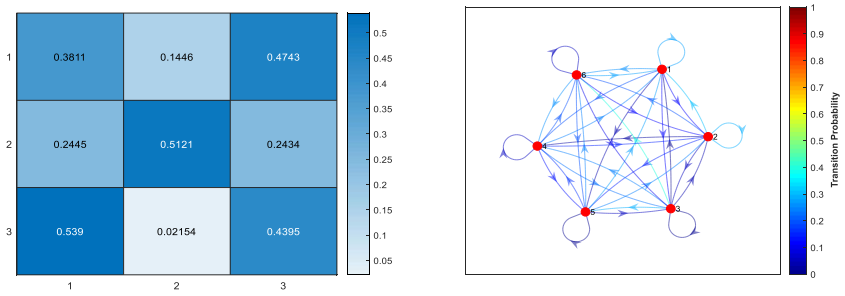

Table 9: Social welfare transition matrix for the USA.

This matrix defines the transition of these states at different intervals of time. In the respective economy, there is a probability (0.3811) for individuals to attain social welfare in their respective states. Furthermore, an individual with a higher level of trust has a probability (0.5121) of attaining social welfare by remaining in their state. Furthermore, a society where individuals allocate their income for consumption through the digital platform has more chances of attaining overall social welfare by saving tremendous costs with probability (0.4395). Henceforth Markov process is suitable to predict the future state of this economy independent of the past as different proportions of trust, social welfare, and income-based on $S_w[= f(y,T)]$. Therefore after performing several iterations, we can determine the steady state of these values where economic efficiency can be achieved by optimal allocation of resources in the digital economy.

STEADY-STATE AFTER 11 Iterations	**0.4284**	**0.1458**	**0.4258**

Table 10: Steady-State after Eleven iterations for the USA.

After 11 iterations, i.e., convergence is achieved, suggesting that due to the advent of technological advancement, time and costs of transactions in the market decline. Moreover, it can be further demonstrated by the eigenvalue plot showing the mixing time of the Markov chain. Thus a sharing economy can help attain responsible consumption and production choices.

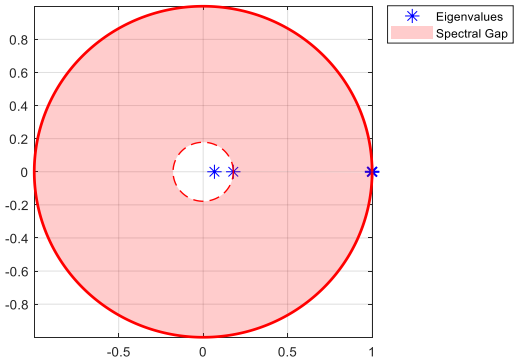

Figure 1: Spectral gap $|1 - \sigma_{SLEM}|$ The outer and inner dotted circle shows the mixing time required by Markov chains. From the above figure, it is evident that the spectral gap is vast, explaining quicker convergence towards steady-state as (tmix ~0.64)

4.1.2 The benefit of the digital economy during the Pandemic (Covid-19)

Digital economy benefits can be analyzed based on the stock markets' return of Google, Microsoft, Facebook, YouTube, Amazon, and Walmart during the pandemic. Our primary concern is how stock returns of digital platform reacts during covid-19. Therefore (Campbell and Desrozier, 2020) asses that Until 21 February 2020, stock markets were strongly influenced by the increase in infected individuals and this volatility remains till 20 March 2020. consequently, due to interventions by central banks and the Government through credit facilities, government guarantees, lower interest rates, and lockdowns, stock markets are returning to normal. However, digital markets were least impacted by COVID-19, as is evident in the case of Faang companies, namely, Facebook, Amazon, Netflix, Apple, Walmart, Microsoft, and Google. Moreover, increase in investment in these companies' stock because, due to COVID-19, households and Businesses switch to purchasing products online, thus strengthening the digital economy. Furthermore, due to being digital, there is less volatility for these companies now, compared to the financial crisis in 2008, so more weight can be allocated for portfolio allocation in risky assets. There has been much research on how universities have responded to the COVID-19 epidemic but far less on how the pandemic has affected students, as this study admits. Digital mechanisms facilitated students and universities during the pandemic. The research shows how universities can listen to students' voices to learn from the unexpected implications of their policies during the epidemic (Osuna et al., 2021).

Online marketplaces like eBay and Amazon rely heavily on trust between buyers and sellers to function effectively. Trust is built through ratings and reviews and depends on trust to maintain user engagement and generate revenue through targeted advertising. Users are more likely to engage with content and advertisements they trust, and advertisers are more likely to spend money on platforms with high user trust. Cryptocurrencies such as Bitcoin rely on trust in the underlying technology and the community of users and developers that support it. Trust is built through mechanisms such as the public ledger (blockchain) and the decentralized nature of the network. A study by Urquhart (2016) found that trust in the Bitcoin network positively correlates with its market value. This relationship is strengthened when the network experiences a period of high usage. In each of these examples, trust plays a critical role in shaping the social welfare outcomes of the digital economy. By modelling changes in trust over time, we can better understand how changes in the digital environment impact social welfare.

4.1.3 Generalized transition matrix for Digital Economy

Hence our transition matrix can be further generalized for other developed economies with a large proportion of individuals relying on consuming digital commodities with corresponding six states with different levels of trust and income, i.e. high, low, and medium. It can further generate our social welfare function. In a digital economy, data flow freely removes distance restraints and reduces transaction costs. It led to the spread of ideas worldwide, renovating the trend of international trade by including a global value chain system in which goods and services are sold directly to customers.

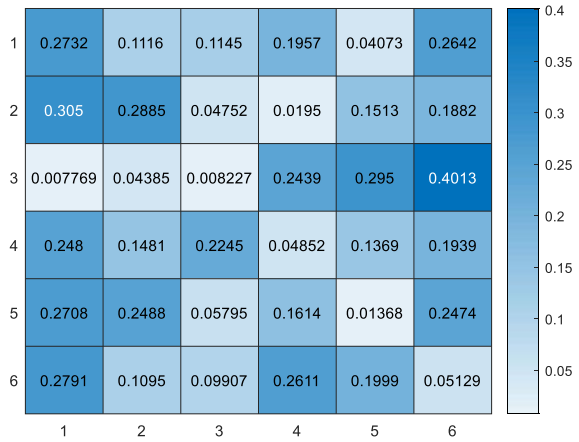

Table 11: Social welfare transition matrix for the USA.

This matrix defines the transition of these states at different intervals of time. In the respective economy, there are probabilities for individuals to attain social welfare in their respective states. Moreover, an individual with a higher level of trust may have a chance to attain social welfare by remaining in their state. Moreover, Crepaz 2008 suggested that people with high generalized or universal trust are more likely to endorse social welfare state phenomena at the individual level. Furthermore, digitization promotes that "universal trust" component through transparency. Therefore, after performing several iterations, we conclude that convergence toward optimal allocation of resources is achieved in a shorter time, suggesting positive trust as a more vital determinant of social welfare. (Hamm et al., 2013) Trust is an essential social indicator in the context of the digital economy since it affects consumer decisions and the spread of innovative technology. Businesses and governments should prioritise trust-building efforts for the health of the digital economy.

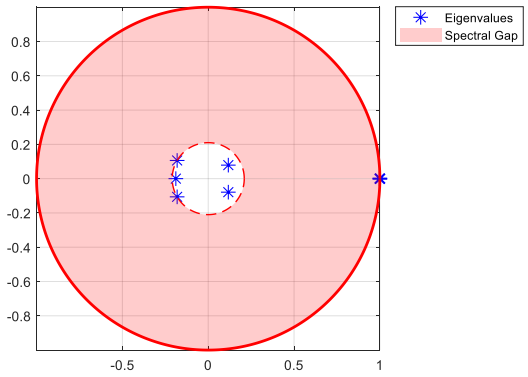

Figure 2: Similarly, for the generalized transition matrix of the digital economy, the spectral gap is very large elaborating faster convergence towards steady-state indicating trust as a determinant of social welfare.

4.1.4 Findings of Digital Economy

According to the Bureau of Economic Analysis (BEA), the digital economy contributed to the GDP of the USA through a 6.9% share, equivalent to $1.35 trillion. This revenue mainly comes from tech giants like Google (37.2%) and Facebook (22.1%) of the market share. However, the prospect of regulation may introduce hurdles to that growth. Additionally, those employed in the digital economy grossed $132,223 compared to $68,506 per worker for the USA economy. Furthermore, Brynjolfsson et al. (2003) find that increasing reliance on online bookstores enhances consumer welfare from $730 million to $1.2 billion, ten times larger than consumer welfare gain from increased competition and lower market prices. Furthermore, in the USA, individuals have a confined level of trust in institutions, with the allocation of income for achieving optimality. Results were consistent with (e), where individuals maximize utility from consumption, and the Government boosts their revenue, resulting in social welfare maximisation.

$$S_w{}^* \geq S_{WA} > S_{wB}$$

$$\pi_w{}^* = T + y$$

$$U_W{}^* \geq (\psi)\, U_D(\, C_A\,) > \ (\eta)\, U_{ND}\ (\, C_B)$$

$$H_D = H\,{}^*_D$$

Consequently, preferences and optimal policy are shaped by those in $H\,{}^*_D$ Having an efficient level of human capital, social capital, and digital skills, which are in the majority in the case of the USA. Having an optimum level of social welfare generate benefits among one of them is shown as a higher level of trust in institutions which may lead to a reduction in time required for transactions and reduce overall extra costs in the market, thus boosting economic productivity (Pitlik and Rode, 2020; Napoli et al.2019). S_{WA} has socioeconomic effects through digital enabling

infrastructure, e-commerce transactions, digital media content creation, and advertisement. Likewise, estimates that BEA utilized were based on the quantification of goods and services that are digital. However, there are several challenges in estimating those goods that are partially digital. The digital economy can play a significant role in achieving responsible consumption and production by enabling new ways of tracking and managing resources and providing new opportunities for sustainable business models. For example, digital technologies such as the Internet of Things (IoT) and blockchain can be used to track and manage resources in real time, allowing for more efficient use of resources and reducing waste. It can lead to more sustainable production and consumption patterns. The findings of (Hamm et al., 2013) imply that trust in one's disposition is not a strong predictor of trust in others, but rather trust in government institutions, scepticism toward the law, and a sense of moral responsibility to follow the law. Policymakers working to boost public faith in the justice system should consider this. In this regard, (Hamm et al., 2019) research has important implications for advancing our knowledge of political trust. It may help direct initiatives to increase social well-being via responsible leadership and citizen engagement.

Additionally, digital platforms and marketplaces can provide new opportunities for sustainable business models such as the sharing economy and circular economy. The sharing economy, for example, enables sharing resources such as cars and housing, reducing the need for individuals to purchase their own resources and therefore reducing overall resource consumption. The circular economy promotes sustainable products and materials, reducing the environmental impact of production and consumption. Voluntary collaboration is essential to natural resource management's (NRM) success, and trust is an integral part of it (Hamm et al., 2016). This research emphasizes the significance of a holistic assessment and openness to vulnerability in productive partnerships, societal welfare and long-term growth; understanding what drives trust in NRM is essential. (Slagle et al., 2021) Discuss how trust affects organisational behaviour, including how people respond to management's decisions and how they make sense of information. Promoting good resource management has consequences for societal welfare and sustainability, making understanding trust in NRM crucial. Digital technologies can also provide new opportunities for consumers to make informed choices about the products they buy by providing access to information about a product's environmental impact, ethical sourcing, and other sustainability-related information.

4.2 Non-Digital Economy

Individuals can be classified based on the level of trust prevailing in society, and a transition matrix can formulate their corresponding income level. For Example, if an individual resultant welfare dimension is said to be in state 1, with varying levels of trust to be in state 2. Moreover, if the corresponding income level is in state three, the transition probabilities from one

state to another are depicted. Therefore Young (1993) and Feng 2019 suggest that medium-trust countries need more vital institutions to prevent the trust from breaking up to the lowest level in the long run. Developing economies like Pakistan have weaker rules of law provided by the Government, acting as a negative stimulus for growth in terms of lower government revenues and lower individual trust in the Government.

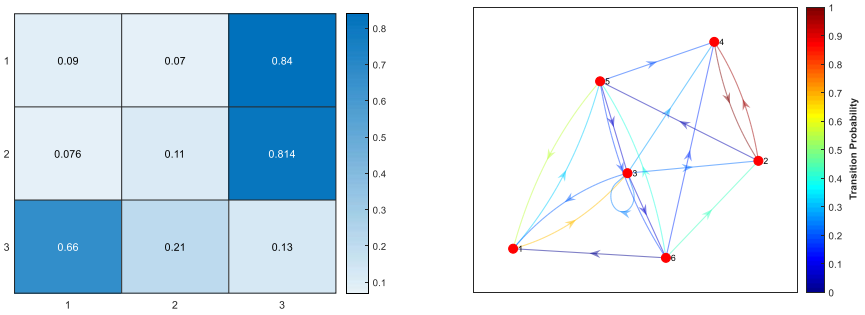

Table 12: Social welfare transition matrix for developing economy (Pakistan)

This matrix defines the transition of these states at different intervals of time. In the respective economy, there is a probability (0.09) for individuals to attain social welfare in their respective states. Furthermore, an individual with a higher level of trust has a probability (0.13) of attaining social welfare by remaining in their state, which is very low. Furthermore, a society where an individual allocates his income for consumption through non-digital mechanisms has fewer chances of attaining overall social welfare with probability (0.11). Therefore (Uslaner and Rothstein, 1999) contend that a low level of trust driving down the social capital among countries is due to less control of the Government in reducing inequality, which causes a social trap.

Steady state after 38 Iterations	**0.366**	**0.4890**	**0.1442**

Table 13: Steady-State after thirty-eight iterations for Pakistan

Convergence is achieved after 38 iterations for developing economies like Pakistan, which suggests a low level of trust in institutions and ambiguous impact of income and trust on social welfare due to continuing systematic frictions in the transactions market. It can be demonstrated in the figure below

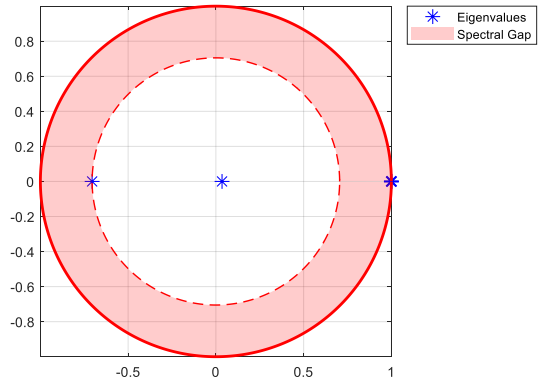

Figure 3: For the non-digital economy (Pakistan) difference between the two circles is very thin, indicating slower convergence and mixing rate

4.2.1 Generalized transition matrix for Non-Digital Economy

Trust is an essential constituent for determining the size and capacity of social welfare. In this regard, Bjornskov (2008) suggests three components necessary for preserving social trust: confidence in political and legal institutions, lower bureaucratic corruption, and private property rights protections. However, those economies that are underdeveloped or in the developing stage consistently lack these defined components. Furthermore, an increase in income inequality leads to a decrease in trust. In this regard, D' Hernon court and Meon (2011) contend that low-trust citizens are more likely to hide their income and business activity from the Government, thus weakening their capability to finance significant social welfare. Hence our transition matrix can be further generalized for other developing economies with a large proportion of individuals relying on consumption non-digital platforms.

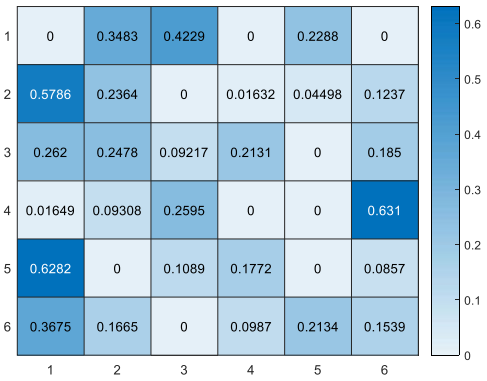

Table 14: Social welfare generalized transition matrix for Pakistan

In this era, the internet is crucial for providing information about politics, business, and culture prevailing in societies. According to Kim et al. (2009), digitization has divided society into two segments: a digitally endowed group receives better information than another digitally challenged group, and their outcomes differ. Therefore, the alternative preferences chosen by the majority become the choice of the overall group. Therefore, (Kim et al., 2009) elaborate that digital exclusion causes online and offline marginalization. Moreover, (Fink et al. 2005) explain that countries with less openness to global information, i.e. (weaker ICT) lead to more communication costs, thus impacting trade. The pace of digitally induced growth is not determined by the rate of technological innovation but by the human and social capital involved. This matrix above demonstrates transitioning of trust and income to determine social welfare. However, 0 at specific locations indicates that the state d_i does not move to the future state d_j , therefore, (P_{ij}) = 0 indicating a weak relation between trust and the social welfare component.

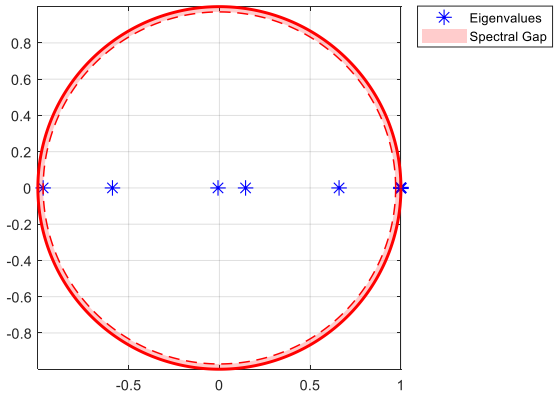

Figure 4: the spectral gap is thin for Generalized non-digital economy that indicates slower mixing, i.e. (tmix ~ 33.904)

4.2.2 Findings for Non-Digital Economy

Results were consistent with a framework where due to being a non-digital economy has to face tremendous economic costs. Since Pakistan is a ubiquitous developing economy having individuals with influential business interests and a government with the least efficient management of resources, moreover, economic institutions lack independence and face rent-seeking. Despite recent developments, there is a lack of transparency in government expenses along with a weaker rule of law prevailing in the economy (WGI, 2016), resulting in the lowest level of trust by individuals in Government. It may be due to spending a more significant portion of income on consumption through non-digital platforms, due to which a significant portion of the economy is undocumented; as a result, the digital sector cannot contribute to economic growth.

Furthermore, lack of interest and investment by the Government and a less efficient labour force result in the long interval to achieve stationarity.

$$S_w{}^* < S_{wB}$$
$$U_W{}^* < (\psi)\, U_D(\, C_A\,) < \,(\eta)\, U_{ND}\, (\, C_B)$$
$$L_D = H\,{}_s^* < \, L_D^*$$

The lack of institutional framework and the weaker rule of law provided by the Government resulted in inefficient outcomes. Hence young individuals with minimal digital skills provide individual services to firms abroad. Moreover, Governments in non-digital economies face corruption due to less transparency and non-documentation, causing mistrust between Government and individuals. Consequently, based on our results, economic disruptions can be predicted.

One potential consequence is that a less digital economy could lead to increased environmental degradation, as digital technologies and platforms can be used to improve environmental sustainability. For example, digital platforms can facilitate the sharing of resources, such as cars and tools, reducing the need for individuals to own these items and thus reducing the environmental impact of production and consumption. Additionally, such technologies can be used to improve the energy efficiency of buildings, transportation systems, and industrial processes, which can also reduce the environmental impact of economic activity. For the sake of social welfare and public safety, one must understand the prevalence of extremist beliefs and violent mobilization activities in online groups (Scrivens et al., 2021). In order to foster social cohesion and avoid violent actions that might damage society, it is essential to recognize and fight such extreme views.

In such an economy, there will also be increased poverty and inequality, as digital technologies and platforms can be used to improve access to economic opportunities and services. For example, digital platforms can connect individuals with jobs, education, and healthcare, which can help reduce poverty and inequality. The research also emphasises the need to improve incentives for cross-sector cooperation and increase opportunities for social and intellectual interactions across groups to increase trust between various ethnic groups during national strife. This study sheds light on the factors contributing to trust's growth in the classroom and offers concrete suggestions for fostering inter-group trust (Ben et al., 2023). Additionally, a less digital economy could lead to limited access to information, resulting in a less educated population and a reduced ability for people to communicate, connect and collaborate. It could lead to less effective environmental policies, fewer environmental conservation opportunities, and less awareness of environmental issues. Examples of how a less digital economy could impact the environment include decreased use of digital platforms for ride-sharing and carpooling, leading to increased personal car usage and *higher emissions.* Furthermore, the subsequent decline in the use of digital tools for telecommuting leads to more people commuting to work by car, resulting in higher

emissions. A decrease in the use of digital tools for remote learning and telemedicine leads to more people travelling to physical locations for education and healthcare, resulting in higher emissions.

4.3 Policy Implications

Comparatively developing economies like Pakistan have remarkable potential in the youth population. However, there is a lack of digital skills, so they are losing what the USA is gaining annually. Suppose developing economies specialize in youth in terms of investing in promoting human and social capital along with the effective rule of law provided by the Government. Furthermore, it can help foster mutual trust among various stakeholders and increase transparency, reducing corruption and transaction costs prevailing in the economy. In this regard, the Digital economy has enormous potential as it is predicted to increase the GDP of Pakistan, expectedly to more than $45 billion if the Government efficiently adopts it. For instance, India's digital economy has grown significantly in recent years, with the government promoting digitalization and investing in initiatives such as the "Digital India" campaign. As a result, India's digital economy is projected to reach $1 trillion by 2025. the annual revenue generated by the US because of being a digital economic state is $1.13 trillion, BEA (2016). Similarly, Pakistan has taken steps towards digitalization, with the government launching initiatives such as the "Digital Pakistan" campaign. The country has seen a significant increase in digital payments and e-commerce, with platforms like Daraz, Zameen, and PakWheels gaining popularity. Moreover, freelancing is becoming a significant source of income for the country, with Pakistan ranking among the top freelancing countries globally.

To fully realize the potential of the digital economy, it is crucial to invest in promoting human and social capital, along with effective governance, transparency, and reduced corruption. By doing so, developing economies like Pakistan can leverage the digital economy to drive economic growth and development, as the USA and other countries have already done. However, there is still a long way to go, as the digital divide remains a challenge, and the population lacks digital literacy and skills. Economically, the digital economy has the potential to create new jobs and business opportunities, especially in areas such as e-commerce, digital services, and IT. It can also increase productivity and efficiency in various sectors such as agriculture, finance, and healthcare and increase access to global markets. Furthermore, it can also increase access to financial services and thus help to reduce poverty. Socially, the digital economy can potentially improve access to education, healthcare, and other essential services, particularly in rural and underdeveloped areas. It can also improve access to information and communication, which can help to promote social and political participation and increase civic engagement.

It should be mentioned that to fully realize the potential of the digital economy in Pakistan, various difficulties need to be solved. These include: Limited access to technology and internet infrastructure, especially in rural and poor regions. Limited access to digital skills and knowledge

may limit people's and enterprises' capacity to engage in the digital economy. Limited regulatory and legal frameworks may impede the expansion of the digital economy and restrict enterprises' capacity to operate and compete. Cybersecurity concerns and data protection which has been a big worry in recent years. Overall, the digital economy has enormous potential to promote economic and social growth in Pakistan, but overcoming these difficulties will be crucial to achieving this promise fully.

CONCLUSION

The findings of this study form a basis on which prevailing efforts at improving the definition of the valuation of goods and individuals' decision-making in society can be evaluated and progressed. Our study can be significant for various developing and underdeveloped countries to foster the growth of their economies in underlying pandemic scenarios. Furthermore, individuals' decision-making is linked to how they value different goods. Therefore, it can be accessible to interpret the valuation of commodities in the market and try to discover consistency of Social welfare in society. Similarly, growing literature explains the economic impacts of trust through increased trade and innovation. Remarkably, social disparity creates less demand for the redistribution of resources. Government policies should restore trust by reducing market wage dispersion, changing the minimum wage, or forming collective bargaining. After all, people are willing to give away their time, donate it, or sell it for a price, but far fewer easily give away their trust or are willing to sell it. Of course, the same trust acquired in a person is how we must achieve it in digital business: through honesty, consistency, reliability, transparency, accuracy, and quick admissions of errors when they occur. The trust economy will increasingly value authenticity and reliability, with data quality and recency playing a critical role.

There is a need to look through the difficulties created by excessive consumerism and meaningless production as two extremes of the consumption problem. Most of us purchase something out of the need for instant gratification with a veil of necessity in our lifetime. We are consuming more for instant gratification while, at the same time, mental well-being statistics are falling exponentially. As humans, we seem to have some authentic essential values and desires; we have hunger, the need to have sex as a primal instinct, and the need to socialize. We have all these authentic essential values that need to be met. We are locked into an ever-growing consumption pattern that influences our society's health and people's. Due to our endless consumption, it has become a culture to throw away goods, large penthouses, our globe-trotting travel habits large, and powerful cars driving great distances point to an expectation of endless consumption without penalty. The growth-forever paradigm serves the elites well by creating conditions under which their wealth will grow faster. For the remainder of the population, a fascination with material goods masks the underlying weaknesses of debt, resource depletion, and long work hours, diminishing quality of life.

Overconsumption lies at the heart of many of our current fiscal, social and environmental problems. Technology has often caused several environmental challenges, e.g., producing and

recycling electronic devices and specific social media platforms for advertisements that boost online shopping, further shifting individuals towards irresponsible consumption and production choices in a lifetime. However, technology can be employed to motivate individuals regarding responsible production and consumption patterns. The transition towards a responsible consumption level entails fundamental challenges. It is more critical to restructure our consumption patterns to achieve sustainable development targets. Technology plays a crucial role in increasing responsible consumption and production choices, e.g., through smartphone apps (tracking energy or water consumption, reducing fuel consumption through online payments), green technology products, including solar panels, electric cars and industrial innovation. Real success is in inspiring people to care not only for their wants but also about the people and our beautiful planet.

In this century of digitization, every market factor is transforming through a change in payment services, and the scale of human and social capital is changing continuously. Its direct impact can be on consumers, firms, and the Government and indirectly related to managing and dispersion of technologies. Since digital transformation is a benefit for developing economies, there is a lack of understanding regarding how to use these advanced technologies to maximize opportunities for innovation. Moreover, mutual trust among key stakeholders and individuals is crucial for its attainment. Furthermore, in the digital age, trust is easy to gain but difficult to retain as once the company's reputation is damaged, it is hard to gain. It causes enormous damages through loss of revenues. However, the digital economy allows regional businesses to indulge in a long-term free-market economy.

The digital economy can play a significant role in achieving responsible consumption and production by providing new ways of tracking and managing resources and new opportunities for sustainable business models. Here are a few examples of how this can be achieved: Smart supply chain management: Digital technologies such as blockchain and IoT can be used to track and monitor the movement of goods throughout the supply chain, allowing for more transparency and accountability in the production process. This can help companies identify and address environmental and social sustainability issues. Online marketplaces for second-hand goods: Digital platforms such as eBay, Craigslist, and Facebook marketplace enable the buying and selling of second-hand goods. It can reduce consumption's environmental impact by prolonging product life and reducing the need for producing new products. Digital platforms for sharing resources: Digital platforms such as Airbnb, Zipcar, and bike-sharing services enable the sharing of resources such as housing, cars, and bikes. It can help reduce the environmental impact of consumption by reducing the need for individuals to purchase their resources. Digital tools for sustainable consumption: Digital tools such as mobile apps, websites, and smart devices can provide consumers with information about the environmental impact of products and services, as well as information about ethical sourcing and other sustainability-related factors. This can help consumers make more informed choices about the products they buy.

Developing economies must increase their potential for sustainable development by enhancing poor infrastructure, developing ineffective skills, and removing socioeconomic barriers that inhibit growth (Guiso et al., 2018; Wu, 2020). There is a widening digital skills gap in various developing economies. Therefore, trust, discretion, and openness issues must be tackled efficiently. Growth in the future will not be determined by the rate of digital innovation but by individuals who can efficiently utilize it. To achieve future economic prosperity, we require people to be more involved by promoting skills, education, and social capital. Trust in the digital economy is a determinant of social welfare, and fostering it through effective governance, transparency, and reduced corruption is essential for unlocking the digital economy's full potential.

Conflict of interest: It is hereby affirmed that there is no conflict of interest.

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