Received: 5 February 2022 | Revised: 9 May 2022 | Accepted: 9 May 2022

DOI: 10.1002/bsd2.217

RESEARCH ARTICLE

Business Strategy and Development

WILEY

The effect of the informal sector on sustainable development: Evidence from developing countries

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Abstract

This study aims to explore the impact of the informal sector on the sustainability of development. A large panel data set of 50 developing countries that spans over 2010–2019 has been utilized to this end while the informal sector is evaluated in terms of working poverty. Selecting indicators from three dimensions of sustainability, that is, economy, society, and environment, this study has constructed three indices and combines those to construct a symptomatic composite index of sustainability. Both the short run and long run panel data models have been applied to empirically investigate the impact of informal economic activities on the sustainability of development. Economic growth, national expenditure, and economic freedom of countries are used as control variables in the models and the estimated outcomes are found to be robust in empirical investigations. The outcomes of the study imply that the informal sector plays a detrimental role in the sustainable development of developing countries while economic growth and economic freedom contribute positively. Therefore, the prescribed strategy is to reduce informality from business and other economic activities that limit the scope of the economies and to understand the domain through which interventions can be made to move to a more formal economy. Integration of informal business and SMEs into the formal sector and firm-level awareness building in Corporate Social Responsibility can also be suggested to find a path towards sustainable development in addition to increased economic growth and enhanced economic opportunities of the developing countries.

KEYWORDS
developing country, economic freedom and opportunity, economic growth, informal sector, sustainable development

JEL CLASSIFICATION
O11, Q01, O43, E26, F63

1 | INTRODUCTION

The informal sector has wide-ranging impacts on the economic and social development of developing and less developed countries and it has become a central issue in development discourses (Arvin-Rad et al., 2010; Elbahnasawy et al., 2016; La Porta & Shleifer, 2014). The informal economy that comprises small and medium enterprises and relates to economic activities outside of government regulation or

taxation is largely visible in these countries (Adeola et al., 2019; Elbahnasawy et al., 2016). It is highlighted for entrepreneurship, business, income, and employment since public authorities often face inadequacy of resources to support and regulate business activities in developing countries (Maloney, 2004; Martinez et al., 2015). Informal economic activities have been projected as the thematic area in United Nation's Sustainable Development Goals (SDGs), SDG 8.3 and SDG 10.2 (ILO, 2015b, 2015a) and are considered one of the most significant challenges to sustainable development in the 21st century (Huang et al., 2020). Poverty, population, pollution, participation, policy and market failures (including good governance), and prevention and management of disasters are the strategic factors to govern sustainable development and are regarded as the major pillars on which sustainable development rests. To achieve sustainable development two vicious cycles that feed on each other must be addressed: poverty and development, leading to resource depletion, and environmental degradation (Roger et al., 2008). The informal sector links to both of these cycles in developing countries due to its association with low income, low productivity, labor rights abuses, unfair competition, and environmental degradation. Therefore, sustainable development is considered to be rooted in a sound understanding of the informal sector (Adeola et al., 2019). It needs to be addressed in the development planning of these countries, especially when actions taken in the direction of the SDGs are to be inclusive and favorable to the poor.

Sustainable development is viewed as the ideal paradigm of development and a quest for satisfying three aims: environmental protection, economic efficiency, and social equity (Briassoulis, 1999; Ruzek, 2015). In the Global Sustainable Development Report (2019), the informal sector is highlighted as a potential contributor to more than four entry points of an urgent transformation in socio-economic and environmental system that may separate over nations but can add up global outcomes to ensure human well-being, social health and minimal environmental impact as a priority. However, the role of the informal sector in sustainable development has been debated in many studies due to its pervasive characteristics of non-regulation by formal institutions. From the viewpoint of sustainability, the main issue regarding the informal sector lies in the fact that production and business activities in this sector do not ensure long-term economic efficiency and welfare although it bears the potential of more effective satisfaction to social needs. The informal sector creates a decentralized model of economic organization that makes formal coordination and planning a cumbersome task by distorting the factor, resource, and product market in many ways (Briassoulis, 1999). It is negatively linked to formal investment and impedes growth by hindering the government from raising revenue. Thus, it limits public sector resources from playing a complementary role to private investment through infrastructure development and improvement in the business environment (Misati, 2010). Economies with high informality face difficulties accessing credit, providing poor protection of investors and running with ineffective tax and licensing systems, which increases the risk of collapse of the formal sector (Estevao et al., 2022). Moreover, precarious work conditions are visible in informal enterprises where workers are deprived of their rights along with increased risk of abuse and job uncertainty (Estevao et al., 2022; Dell'Anno, 2018). Contrary to these views, the informal sector is viewed as the lifeline for the poor and acts as a reasonable response to the over-burdened regulations that ultimately provide the economy with a dynamic and entrepreneurial spirit with competition, innovation, efficiency, and investment (Schneider, 2005; Misati, 2010). In the context of environment, informal economic activities are often linked to land, water, air and sound pollution-in one hand and on the other hand are applaud as a cleanser of environment due to their capability to re-use waste materials erupted from formal sector (see, Chirisa & Bobo, 2018; Elgin & Oztunali, 2014; Huynh, 2020; Köksal et al., 2020). Under such a backdrop, this study has initiated a comprehensive and holistic investigation to explore the effects of informal sector activities on different dimensions of sustainability.

The informal sector activities are operated outside the world of the formal economy, where small-scale production and business activities are carried out by subsistence entrepreneurs and workers without contractual agreement and division between labor and capital. These unincorporated private enterprises are poorly managed, undercapitalized, less-productive, and transient that get no coverage or insufficient coverage by formal agreements (Azunre et al., 2021; Eijdenberg et al., 2019; ILO, 2013). They produce goods and services at a lower level of organization and technology with a preliminary objective to generate employment and incomes. These activities are largely unrecorded, unrecognized, and are often considered as a cause of improper functioning of the formal sector that is capable of affecting sustainability (Briassoulis, 1999; Ruzek, 2015). Since the workers become business owners with little preparation to manage the business, their profit gets meager and usually gets constrained to informal getting failed to comply with government regulations, taxes, and property rights (Barron, 2020; De Soto, 1989). These constraints give rise to a contrasting view of the informal sector activities and publicize its hidden danger due to unfair competition with formal firms. Activities in the informal sector are often considered to be the byproduct of poverty and deliberated to be the last resort for poor, unskilled, low-paid workers (Basu & Chau, 2015; De Soto, 1989; Ghose, 2017; La Porta & Shleifer, 2014). Maintaining informal employment is argued to play a role in poverty reduction and socio-economic stability (Huang et al., 2020), while some others argue in favor of reducing the size of the informal sector for pursuing poverty reduction (Chen, 2006; Larsson & Sevensson, 2018). Since eradication of poverty is one of the relevant areas of sustainable development, this study has analyzed informal sector activities in terms of poverty beneath employment following Loayza and Rigolini (2011) and Chen (2012) to assess its impacts on the facets of sustainable development.

The informal sector has appeared as a means of survival to a vast section of people in developing and less developed countries. Fifty percent to 90% of the non-agricultural workforce in the developing world are employed in informal activities (Gutiérrez-Romero, 2021). It provides earning opportunities for 62% (2 billion) of the entire working population of the world, of which 90% are in low-income countries, 67% in middle-income countries, and 18% in high-income

countries (ILO, 2020). Considering the significant presence of informality and its dominating role in employment generation, issues linked to the informal sector should gain attention in policy-making, particularly in developing countries. The present study will contribute to this end in several ways. First contribution is to focus on the impact of the informal sector on the sustainability of development of developing countries where the informal sector is evaluated by poverty in employment. The second contribution is to explore freshly the long tradition of developing and using indicators for improved decision-making in policy issues related to economic development, social progress, environment and natural resource, community health, and sustainability (see Miller et al., 2013; Hezri & Dovers, 2006). This study has constructed indices on the above-mentioned aspects of sustainability outcome and has combined those in a symptomatic composite index of sustainability utilizing a panel data set of 50 developing countries.[1] The third contribution lies in the empirical investigation that employ both short-run and long-run econometric techniques. These techniques rigorously address the problems related to endogeneity, bias and measurement errors and confirm the results in the long-run adjustment mechanism. This comprehensive and robust empirical evidence will guide the impact of informal activities on the prospect of sustainability.

The structure of the paper is as follows: Section 2 contains literature review, Section 3 describes the data and explains the methodology, Section 4 presents and discuss the result. Section 5 concludes the study by summarizing it and suggesting some policy measures.

2 | LITERATURE REVIEW

The topic of assessing sustainability in informal economic activities of developing countries has not been explored enough. This section will discuss the existing evidence on how the main features of informal sector activities affect the three facets of sustainability: economy, environment, and social equity under three sub-sections.

2.1 | Informal sector and the economy

Amidst the persistent view of the existence of large informal sector as a hindrance to investment, growth, and development, it has appeared in an expansionary manner in developing countries due to the rapid growth of already widespread unemployment in these countries (Misati, 2010; La Porta & Shleifer, 2014). In Pakistan, half of the total GDP is sourced from the informal economy which is revealed by the study of Khuong et al. (2021). The significant positive impact of the informal economy on the growth of nominal GDP was also revealed in Nigeria by Yelwa and Adam (2017). The informal sector was found to be dependent on economic growth, working-age population, government policies, and trade-related globalization in developing countries by Pham (2017). A well-functioning and regulated informal economy was mentioned as a critical prerequisite for achieving sustainable economic growth by Yelwa et al. (2015). However, since the linkage between informality, growth and inclusiveness was not fully understood, extensive informality was recognized as an obstruction towards long-run economic development and poverty alleviation by their study. Elgin and Birinci (2016) projected an inverted U relationship between the informal economy and economic growth in the long run where countries of low income were found to have a negative correlation between the two while the opposite was revealed for high-income countries. A one-way causal relationship of informality with GDP was established by Duarte's (2017) study on Spain though an alternative model failed to find a long-run equilibrium and causal relationship between these two. Institutional quality was identified as an important interacting factor in economic growth and the shadow economy relationship by Baklouti and Boujelbene (2020). In their study, higher GDP per capita was associated with a smaller shadow economy in countries with high institutional quality, while increased GDP per capita has no influence on the size of the shadow economy in countries with low institutional quality. Relative volatility of consumption to output positively influenced the size of the informal economy. Horvath (2018) revealed this by constructing a two-sector real business cycle model of a small open economy with a poorly measured informal sector where an increase in country interest rate generated a contraction in output, investment, consumption, and an expansion of the informal sector.

Recent studies focus more on formalization of business. Barron (2020) has found increased evidence of formalization of small-scale enterprises after examining the effects of two large business training programs on formalization of microenterprises in Peru. The opportunity to reconsider the business plan, the declaration of the tax procedures, and access to basic capital have worked behind the improvement by this study. Estevao et al. (2022) have demonstrated several possible alternatives for reducing informality in the African context that are linked to market efficiency, improved access to credit, tax system, and investor protection. Taking into note the transient nature of business in the informal sector Akintimehin et al. (2019) showed that social capital had a significant effect on business performance. This study recommended that informal entrepreneurs take advantage of internal social capital resources and build external social capital since both were found valid for business success.

2.2 | Informal sector and environment

The size of the informal sector is important for the efficacy assessment of environmental policy (Bali Swain et al., 2020). The informal sector was proved to be the long-term driver of ecological footprint levels when it was linked to formal economies by Köksal et al. (2020). In general, a larger informal sector contributes significantly to environmental damage since firms operating in the sector can escape regulatory policies on the environment (Biswas et al., 2012). Projecting an inverted U relationship, Elgin and Oztunali (2014)showed that a lower level of pollution was associated with small and large size informal economies, and a higher level of pollution was linked to medium size informal economies. In case of air pollution (both local and global) the

marginal impact of the shadow or informal economy was found to be positive by Biswas et al. (2012). This study revealed that the damaging impact of the shadow economy on pollution could be reduced by preventing the corruption level, which reinforced the growth of the shadow economy in developing countries. A lower corruption level is also suggested by Bali Swain et al. (2020) for improving the marginal impact of the informal economy on environmental pollution. The positive influence of the informal sector on emissions of local pollutants has been established by this study, although no significant impact has been established on global pollutants, that is, CO_2. The study has pointed out that since the informal sector in developing countries mostly relies on labor-intensive production techniques and utilizes less energy, it leads to lower levels of emissions. While investigating the causal relationship between economic growth and CO_2 emissions in Tunisia, informal sector activities were found to promote environmental degradation, and hence a reduction in the size of the informal sector was suggested by Abid (2015).

Tax enforcement supposed to intensify the problem of environmental pollution according to Huynh (2020). The degree of tax enforcement variable on an informal sector projected an inverse U relationship through the scale effect and deregulation effect in a study by Chaudhuri (2005) where a polluting informal manufacturing sector firm subcontracted for the formal sector. The result confirmed tax enforcement as the key policy tool to reduce pollution but with an increased possibility of growing intensity of informality. Indirect taxes on the formal sector might improve emission scenarios with a welfare tradeoff. Therefore appropriate fiscal policy was recommended in these studies to move to cleaner economies. Introducing a model for an optimal tax that captured substitution between formal and informal parts of the economy, Bento et al. (2018) showed that certain narrower taxes placed on environmental externalities could become more efficient in the presence of the informal sector. Their study suggested that developing countries were better venues for introducing energy taxes because energy tax would correct environmental externalities and collected taxes more efficiently. The indirect method of pollution control was also suggested by Chaudhuri and Mukhopadhay (2006). According to this study the formal sector firms that used output from the informal sector as an intermediate input should burdened with more tax since informal sector units could not afford to pay pollution taxes or installed pollution abating equipment or targeted for their polluting activities.

2.3 | Informal sector and social issues

Although the informal sector accounts for almost one-half of economic activities, and contributes to employment in developing countries (Chen, 2012; Basu & Chau, 2015; La Porta & Shleifer, 2014), there is little consensus on the utility of such employment on poverty eradication (Gulyani & Talukdar, 2010) which is the area relevant to sustainable development. Informal sector workers are forced to accept low-paid jobs with inadequate job security in the cities since they are not in a socio-economic position to wait indefinitely for a high-paid job in the formal sector. Workers are often exposed to difficult and hazardous working conditions in informal firms with no social security or health benefit schemes (Kar & Marjit, 2009; Macgregor et al., 2012). A predominance of monopsonistic exploitation and working poverty conditions in the urban informal sector of South Asia were studied and explained by Gangopadhyay and Shankar (2016). An index of destitution for the working poor in the informal sector of developing countries was constructed by Gangopadhyay et al. (2014) that explained various economic and social variables responsible for worsening destitution among the working poor in the informal sector. This destitution and poverty are neglected in profit considerations. In Bangladesh, the profit scenario of brick kiln industries operating under the informal sector was found to turn negative when associated health impact and other social costs of pollution were accounted by Croitoru and Sarraf (2012). Past levels of inequality have been identified as an important factor in explaining the size of the informal sector in the long run by Gutiérrez-Romero (2021). It was established by Dell'Anno (2018) that countries with a low-level of inequality faced a negative correlation with informality while high inequality increased informality.

Yelwa et al. (2015) found that the socioeconomic factors of the informal sector had a positive influence on the economy. The possibility of performing social responsibility by informal enterprises was investigated by Villanueve et al. (2020) in Mexico city through a face-to-face interview with entrepreneurs. The outcome of this study found the evidence that the informal enterprises could perform the social responsibility in an implicit form despite their adverse and vulnerable conditions. Uzo and Shittu (2019) was able to establish a linkage between informal social responsibility and sustainable development after investigating the mechanism of practicing social responsibility in informal economy of Nigeria.

The informal sector can provide the balance between "Three Es": economy, environment and equity and provide an intra and inter-generational future. Ruzek (2015) opined this and considered the informal sector a change maker that would shift focus from a globalized capital society to eco-localism where local economy and small scale flexible markets with the ability of rapid adjustment to changes in demand would be encouraged and the true cost of goods would be reflected. However, examining the association between the size of the informal sector and the various indicators of sustainable development, Özgür et al. (2021) have found a negative association of the informal sector with most of the indicators of sustainability under their consideration. All these contrasting outcomes indicate a research gap in understanding the nexus between informal business and production performance and the tripartite dimensions of sustainability. Eventually, the impact of informal sector activities on a combined effect of these three dimensions of sustainability remains critical. To fill this gap, the present study aims to assess the impact of the informal sector activities on the overall sustainability of development by constructing and utilizing a composite index of sustainability which will be the first attempt so far on this topic.

3 | DATA AND METHOD

3.1 | Data

This study has employed an extensive panel data set spanning 2010–2019, strongly balanced and consisting of 50 developing countries. The countries are selected from the World Bank classification of countries (WDI, 2019). The availability of data guides the selection of the countries and study period. However, due to the unavailability of recent data set on the size of informal sector of countries (which is the main independent variable), this study has considered a proxy of the informal sector, taking insights from earlier literature. The selected proxy is working poor (WP) recommended by International Labour Organization (2011), which is also an SDG indicator 1.1.1. WP includes all workers who live under the nationally defined poverty line of the countries (US$1.90 PPP per day) and pursue the evidence that informally employed workers receive a lower wage than their formally employed counterparts (Bonnet et al., 2019; Chen, 2006; Nordling, 2017). The data are collected from https://ilostat.ilo.org/data/#. The details of the variables and the source of data for the construction of the sustainability indices (that are the dependent variables in this study) are presented in Table 1 below. Only a small number of missing data are linearly interpolated through E-views software.

3.1.1 | Sustainability indices

This study attempts to construct a symptomatic composite index by capturing three dimensions of sustainability: economy, society and environment to explore its link to informal sector. A critical step in constructing a sustainability index is identifying the sustainability indicators that measure performances under the three broad categories mentioned above. The secondary information sources, for example, relevant literature (see Özgür et al., 2021; UN, 2021), have been used to derive indicators under each index to reflect the concerns about sustainability while availability of data is considered a priority (Miller et al., 2013). Applying the principal component analysis (PCA), the indicators are summarized in a simple way to find a new set of meaningful measures for further analysis (Abeyasekera, 2006). PCA is a multivariate statistical technique that combines and modifies the data from interdependent categories in a way that a new set of mutually independent categories arises which is free from multicollinearity lied in the dataset. It facilitates reducing the number of variables in a data set into a smaller number of 'dimensions' without losing much information. The steps that are followed for computing individual Index using PCA are: a collection of data on selected variables, normalization of variables (since different explanatory variables are measured in different units), and running PCA in the software STATA (version 15) using the normalized values of different variables that produce principal components, that is, variables have significant variations, eigenvalues, and factor loading values (Mahida & Sendhil, 2017; Roger et al., 2008). PCA is suitable for converting the highly correlated data into uncorrelated indices (Roger et al., 2008). The three indices: economic index (EcoI), social index (SocI), and environmental index (EnvI) are constructed in this way and are used for the construction of a composite index of sustainability (CIS). The indicators considered under each index are presented in Table 1.

This study has followed the multivariate method to construct the composite index of sustainability. Equal weights have been assigned for each of the indices since it is critical to give equal attention to each of the three dimensions to achieve sustainability where weights should be $0 \le w_j \le 1$ and $\sum_{j=1}^{3} w_j = 1$ (Roger et al., 2008). Combining with the indices this allows the construction of scale free composite indicator for sustainability as follows:

$$\mathrm{CSI}_{i,t} = \frac{1}{3}\left(\sum \mathrm{EcoI}_{i,t} + \sum \mathrm{SocI}_{i,t} + \sum \mathrm{EnvI}_{i,t}\right). \quad (1)$$

3.1.2 | The control variables

Some relevant variables identified from the literature have been incorporated into the model. The GDP growth rate per capita, National expenditure to GDP and Economic freedom index of countries are used as the control variables in this study. Economic growth is represented by GDP growth per capita, national expenditure is represented by gross national expenditure as a percentage of GDP and both are extracted from WDI (2020). The Index of Economic Freedom (2021), which captures economic freedom, prosperity and opportunity by summing up 12 economic freedom indices, for example, property rights, government integrity, judicial effect, tax burden, financial health, business freedom, monetary freedom, trade freedom, government spending, labor freedom, financial freedom and investment freedom, is collected from https://www.heritage.org/index/explore?view=by-region-country-year&u=637509928185688064#top. It is expected that GDP growth rate per capita, National expenditure to GDP ratio and Economic freedom index of countries will demonstrate positive relation with the sustainability of development.

3.2 | Methodology

3.2.1 | Pre-estimation testing

The study follows some pre-estimation test procedures before applying the main estimation method. It tests for the time series and cross-sectional properties of the panel data set in first hand. Since the countries are from the same economic category they may have inter linkage in political, economic, social and technological issues that need to be detected a priori to select the econometric techniques. If cross-country dependence exists among the panel data set, the estimated parameters may provide inconsistent and inefficient results due to the misspecification of the model. Therefore, four different types of cross-sectional dependency tests have been applied: Breusch and Pagan (1980) BP Lagrange multiplier (LM) test, Pesaran (2004) scaled

TABLE 1 Description of dependent variables (dimensions of sustainable development) and details of the abridged variables used for their construction

Sustainable development dimensions	Definitions	Abridged variables	Introduction to variables	Source
Economic index of sustainability (EcoIS)	Economic sustainability index refers to the ability of the economy to sustain economic growth in the long run (Azunre et al., 2019)	GDP per capita	GDP per capita, PPP (constant 2017 international $)	WDI, 2020
		Trade to GDP ratio	Trade (% of GDP)	WDI, 2020
		Access to Electricity	Percentage to total population under accessibility to electricity	WDI, 2020
		Employment poverty	Employed by sex, age and economic class (less than USD 3.20ppp) per day (in thousands)	ILOSTAT, 2021
Social index of sustainability (SocIS)	Social sustainability index includes the factors that provide preventive capability of the social structure to create and sustain a healthy and socially sound community (Azunre et al., 2019)	Life-Expectancy at Birth	Life-Expectancy at Birth in total years	WDI, 2020
		Maternal Mortality rate	Maternal mortality ratio per 100,000 live births	WHO, 2020 https://www.who.int/data/gho/data/indicators/indicator-details/GHO/maternal-mortality-ratio-(per-100-000-live-births)
		Under 5 Mortality Rate	Mortality rate, under-5 per 1000 live births.	WDI, 2020
		Immunization DPT	Percentage of children immunized for DPT ages 12–23 months	WDI, 2020
		Immunization Measles	Percentage of children immunized for Measles ages 12–23 months	WDI, 2020
Environmental index of sustainability (EnvIS)	Environmental sustainability index includes the factors that need to be considered for the protection of environmental resources to guarantee long term gain (Azunre et al., 2019)	Carbon Dioxide emissions per capita	Average per capita CO_2 emissions, measured in tones per year	Our World in Data. GCDL University of Oxford. https://github.com/owid/co2-data
		Death due to Air Pollution	Share of deaths attributing to total air pollution both outdoor and indoor	Our World in Data. https://ourworldindata.org/air-pollution
		Nitrous Oxide Emissions per capita	Per capita methane emissions in tons of CO_2 equivalent	Our World in Data. GCDL University of Oxford. https://github.com/owid/co2-data
		Population weighted PM2.5 emissions	Ambient particulate matter pollution by average annual population weighted PM2.5 ($\mu g/m^3$)	State of Global Air 2020. https://www.stateofglobalair.org/data/#/air/plot
		Methane per capita	Per capita methane emissions in tons of CO_2 equivalent	Our World in Data. GCDL University of Oxford. https://github.com/owid/co2-data

LM test, Pesaran (2004) CD test, and Baltagi et al. (2012) biased-corrected scaled LM test to check the existence of cross-sectional dependence. Based on the results, the second generation unit-root tests: cross-sectionally augmented Dickey-Fuller (CADF) and cross-sectionally augmented I'm Pesaran-Shin (CIPS) panel unit root tests proposed by Pesaran (2007) have been applied. These tests address cross-sectional dependence in panel data set while verifying the stationary of the variables. Then the study uses the residual-based panel cointegration test suggested by Kao (1999) and Pesaran (1999) and the second-generation panel cointegration test suggested by Westerlund (2005) that takes care of cross-sectional dependence in the data series.

3.2.2 | Estimation method

Fixed effect (FE) and random effect (RE), the two classes of panel estimation approaches, are applied in this study for modeling the panel data. A choice between the two models depends on the investigation of whether the regressors are correlated with individual effects. The optimal model between the two is determined by the Hausman test (1979). This is a Chi-square-based estimate, and if the Chi-square statistic is significant, the FE model should be utilized, acknowledging its relevance over the RE model. The FE model can control all time-invariant differences between individuals and eliminates the bias sourced from the omitted variables that do not change over time. FE model also allows for possible endogeneity (Anton & Nucu, 2020; Aşici & Acar, 2015; Baltagi, 2005). Taking insight from the study by Elbahnasawy et al. (2016) and Anton and Nucu (2020) this study has designed the models as follows:

$$\mathrm{CIS}_{i,t} = \alpha + \delta \mathrm{Informal}_{i,t} + \gamma \mathrm{Economic\ growth}_{i,t} + \rho \mathrm{National\ expenditure}_{i,t} + \varphi \mathrm{Economic\ freedom}_{i,t} + \mu_{i,t} + \varepsilon_{i,t}, \quad (2)$$

$$\mathrm{EcoIS}_{i,t} = \alpha_1 + \delta_1 \mathrm{Informal}_{i,t} + \gamma_1 \mathrm{Economic\ growth}_{i,t} + \rho_1 \mathrm{National\ expenditure}_{i,t} + \varphi_1 \mathrm{Economic\ freedom}_{i,t} + \mu_{i,t} + \epsilon_{i,t}, \quad (3)$$

$$\mathrm{SocIS}_{i,t} = \alpha_2 + \delta_2 \mathrm{Informal}_{i,t} + \gamma_2 \mathrm{Economic\ growth}_{i,t} + \rho_2 \mathrm{National\ expenditure}_{i,t} + \varphi_2 \mathrm{Economic\ freedom}_{i,t} + \mu_{i,t} + \pi_{i,t}, \quad (4)$$

$$\mathrm{EnvIS}_{i,t} = \alpha_3 + \delta_3 \mathrm{Informal}_{i,t} + \gamma_3 \mathrm{Economic\ growth}_{i,t} + \rho_3 \mathrm{National\ expenditure}_{i,t} + \varphi_3 \mathrm{Economic\ freedom}_{i,t} + \mu_{i,t} + \tau_{i,t}, \quad (5)$$

where $\mathrm{CIS}_{i,t}$ indicates the composite index of sustainability for the countries, which is the weighted average of three indices, economic index ($\mathrm{EcoIS}_{i,t}$), Social index ($\mathrm{SocIS}_{i,t}$), and environmental index ($\mathrm{EnvIS}_{i,t}$). Each of these three indices has been calculated by applying the principal component analysis (PCA), and the variables selected as indicators are presented in Table 1. $\mathrm{Informal}_{i,t}$ denotes the informal sector and is represented by the proxy, working poor. $\mathrm{Economic\ growth}_{i,t}$, $\mathrm{National\ expenditure}_{i,t}$ and $\mathrm{Economic\ freedom}_{i,t}$ are the three controlled variables used in the model where $\mathrm{Economic\ growth}_{i,t}$ refers to GDP growth rate per capita, $\mathrm{National\ expenditure}_{i,t}$ refers to Net national expenditure and $\mathrm{Economic\ freedom}_{i,t}$ refers to the indices of economic freedom of the countries. $\mu_{i,t}$ is the unobservable time invariant country specific effect, $\varepsilon_{i,t}$ denotes the disturbances that vary with country i and time t for model-2 where as $\epsilon_{i,t}$, $\pi_{i,t}$ and $\tau_{i,t}$ denote the disturbances for rest of the models 3, 4, and 5, respectively. μs are assumed to be random and distributed independently of the errors. Equations (2)–(5) will be estimated via the fixed effect (FE) and random effect (RE) model and the optimum model selected by the Hausman test will be noted.

To find out the long-run cointegrating vector, this study has applied the fully modified ordinary least squares (FMOLS) and panel dynamic ordinary least square (DOLS) principles, following Rahman and Velayutham (2020), Rahman (2020), and Rahman et al. (2021), that are able to accommodate substantial heterogeneity across individual panel members. This cointegrated panel approach allows pooling the long run information confined in the panel by permitting short-run dynamics and fixed effects as being heterogeneous among different members of the panel (Pedroni, 2001). This method also adjusts least squares to account for the serial correlation effect and endogeneity in the regressors that result from the presence of the co-integrating relationship (Phillips, 1993). FMOLS model corrects for serial correlation and simultaneous bias while DOLS augments the panel cointegration equation with cross-section specific lags and leads to eliminate endogeneity and serial correlation among the variables. Lastly, the long-run adjustment of this model is checked with short-run variables in this study. The error correction model has been estimated by following the Engle-Granger two step procedure.

4 | RESULT AND DISCUSSIONS

Before presenting the main results of this study the summary of the complete data set that are used for index construction and regression is presented in Table 2.

This study has calculated the variance inflation factor (VIF) and tolerance for each variable to check the multicollinearity among the independent variables. Table 3 reports the results of test for multicollinearity which project that there are no multicollinearity issues among independent variables as the tolerance values are not less than 0.20 and the VIF values are not greater than 5 (Gujarati, 2009). This implies that all independent variables selected for the model are independent of each other.

The results for the cross-sectional dependence test are presented in Table 4. The results for all four tests provide evidence of the presence of cross-sectional dependence in the data series.

Based on the results of Table 4, this study has found it relevant to apply the second generation unit root tests. Hence it applies the

TABLE 2 Summary statistics of data set

Variables	Mean	Std. dev	Min	Max	Observation
Working poor	18.094	20.823	0.050	77.230	500
GDP growth rate per capita	2.359	3.525	6.556	18.066	500
GDP per capita	7077.334	5953.539	751.66	25.165	500
National expenditure	109.176	13.063	77.368	187.079	500
Trade to GDP ratio	65.363	31.292	0.200	210.400	500
Economic Freedom Index	56.271	7.843	21.400	70.00	500
Access to electricity	66.608	30.591	4.100	100.000	500
Employment poverty	6292.235	22727.461	1.381	174542.6	500
Life-expectancy at birth	67.359	7.620	47.312	80.279	500
Maternal mortality rate	295.649	412.624	12.000	7444.000	500
Under 5 mortality rate	49.397	33.296	7.000	207.000	500
Immunization DPT	84.894	12.899	23.000	99.000	500
Immunization measles	84.928	12.518	25.000	99.000	500
Carbon dioxide emissions per capita	1.472	1.834	0.034	9.117	500
Death due to air pollution	7.312	1.978	0.290	13.950	500
Nitrous oxide emissions per capita	0.649	1.074	0.060	7.760	500
Population weighted PM2.5 emissions	35.462	17.623	9.300	95.200	500
Composite index of sustainability	0.002	0.599	−2.206	1.842	500
Economic index of sustainability	0.006	0.949	−2.425	2.784	500
Social index of sustainability	0.005	0.973	−2.429	2.353	500
Environmental index of sustainability	−0.007	0.978	−3.843	2.736	500

TABLE 3 The results of the test for multicollinearity

Variable	Tolerance	VIF
Informal (working poor)	0.784	1.27
Economic growth	0.984	1.02
National expenditure	0.837	1.19
Economic freedom	0.907	1.10

CADF and CIPS unit root tests to check for the stationarity of the data. The results of the tests are projected in Table 5 and the findings reveal that all the variables are stationary either at their level or at their first differences or at both.

The results of the unit root tests lead to the check for cointegration among the variables in the models. This study has applied the Westerlund (2005) cointegration test and checked the null hypothesis of no cointegration against the alternative hypothesis of the existence of cointegrating relations among the variables considered in the model. The cointegration test result has rejected the null hypothesis. The Kao (1999) test and Pedroni (1999) test also provide support for the cointegration relationship among the variables in this model (Table 6).

Equations (2)–(5) are estimated via the FE and RE panel data models using the following dependent variables: Composite index of sustainability, economic index, social index and environmental index of sustainability respectively. All the results are presents in Table 7 along with the result of Hausman tests.

The Hausman test results select FE as the optimal model and acknowledge the relevance of FE over RE model for this study. Hence, the estimation results of the FE model are explained in details below.

The panel fixed effect regression results of Equation (2) indicate a significant negative impact of the informal sector on the overall sustainability of development. This indicates that a growth in the informal sector will delay achieving sustainable development in a significant manner. However, economic growth and improvement in economic freedom and opportunities of countries contribute to achieving sustainable development. The results of the panel fixed effect model for each individual indices (economic, social and environmental) provide the similar indication regarding the informal sector towards sustainability. The informal sector performs negatively to sustainability achievement in all three dimensions (mentioned in Equations (3)–(5)), which is significant for the economic and environmental sustainability indices. Economic growth and economic freedom are found to be positive and statistically significant for achieving social sustainability, while economic growth, national expenditure, and economic freedom all are found to be positive and statistically significant for achieving environmental sustainability.

To pool the long-run information contained in the panel by permitting the short-run dynamics, this study has also applied FMOLS and DOLS estimation on Equation (2). The results of the estimation of cointegrating vectors are presented in Table 8 that reveal the

TABLE 4 The results of cross-sectional dependence test

Variables	Breusch-pagan LM	Pesaran scaled LM	Bias-corrected scaled LM	Pesaran CD
Working poor	6001.391***	96.496***	93.718***	44.884***
GDP growth rate per capita	2153.299***	18.754***	15.976***	9.123***
GDP per capita	7840.886***	133.661***	130.883***	54.142***
National expenditure	3043.306***	36.735***	33.957***	3.741***
Economic Freedom Index	3071.389***	37.302***	34.524***	3.142***
Trade to GDP ratio	3883.836***	53.716***	50.938***	13.569***
Access to ELECTRICITY	7754.549***	131.916***	129.139***	84.353***
Employment poverty	6965.770***	115.981***	113.203***	−0.981
Life-expectancy at birth	12104.330***	219.795***	217.018***	110.015***
Under 5 mortality rate	11524.141***	208.072***	205.294***	99.361***
Maternal mortality rate	7812.748***	133.093***	130.315***	77.453***
Death due to air pollution	0.00	−2.493***	−1.671	−2.558***
Carbon dioxide emissions per capita	4711.944***	70.447***	67.669***	31.523***
Population weighted PM2.5 emissions	2829.554***	32.417***	29.639***	15.620***
Methane emissions per capita	3384.200***	43.622***	40.845***	7.352***
Nitrous oxide emissions per capita	2809.104***	32.004***	29.226***	9.932***

***Significance level: ≤.01.

TABLE 5 The results of unit root tests

	Pesaran/CADF—constant and trend		CIPS—constant and trend	
Variables	I (0)	I (1)	I (0)	I (1)
Working poor	−1.578	−2.361***	−1.673	−2.474***
GDP growth rate per capita	−2.175***	−2.283***	−2.541*	−2.874***
GDP per capita	−1.139	−2.447***	−1.211	−2.631***
National expenditure	−1.554	−3.093***	−2.113***	−3.454***
Economic Freedom Index	−1.430	−1.982**	−1.729	−2.560***
Trade to GDP ratio	−1.472	−2.792***	−1.454	−3.069***
Access to electricity	−2.333*	−2.462***	−2.957*	−3.900***
Employment poverty	−1.619	−2.799***	−1.897	−2.786***
Life-expectancy at birth	−0.983	−2.454***	−2.676***	−3.059***
Immunization DPT	−1.076	−1.865	−1.423	−2.22**
Immunization Measles	−1.605	−2.468***	−1.533	−2.469***
Under 5 mortality rate	−1.282	−1.999**	−1.483	−2.201**
Maternal mortality rate	2.757	−1.604**	—	—
Death due to air pollution	−1.381	−2.493***	−1.671	−2.558***
Carbon dioxide emissions per capita	−2.209*	−2.519***	−1.834	−2.134*
Population weighted PM2.5 emissions	−1.484	−2.892***	−1.538	−4.092***
Methane emissions per capita	−2.229***	−1.611	−2.666***	−3.102***
Nitrous oxide emissions per capita	−2.175***	−2.056**	−3.090***	−3.414***
EcoIS	−1.501	−2.223***	−1.538	−3.203
SocIS	−2.388***	−1.545	−3.720***	−1.187
EnvIS	−1.484	−1.829	−1.759	−2.954***
CIS	−1.935*	−2.172***	−2.344***	−2.818***

***Significance level: ≤.01;
**Significance level: ≤.05;
*Significance level: ≤.10.

common long-run relationship. These results are consistent with the outcomes of the Fixed-Effect (FE) model and project a significant negative relation between the informal sector and overall sustainability of development. The results of the control variables also project similar findings of the FE model. The findings are in line with the findings of Özgür et al. (2021) where several indicators of sustainable development projected negative associations with economic informality. The correlogram residual plots for both the models indicate that there is no pattern and therefore they have stationarity in nature.

The results of these empirical analyses provide insights into the fact that informal sector activities have to be scaled down to gain sustainable development in developing countries. Economic growth and improvement in economic freedom, prosperity, and opportunity of the countries can facilitate in the achievement of sustainable development in these countries. Finally, the Error Correction Model results presented in Table 9 confirm the earlier results. The negative and significant value of the error correction term (ECT) implies that the model has the potential to approach long-run stability.

TABLE 6 The results of the tests for co-integration

Co-integration test		
Westerlund		
Statistic	***t*-statistic**	***p*-value**
Variance ratio	2.849***	.002
Kao		
Statistic	***t*-statistic**	***p*-value**
Modified Dickey Fuller *t*	2.013**	.022
Pedroni		
Statistic	***t*-statistics**	***p*-value**
Modified Phillips-Perron *t*	8.943***	.000
Phillips-Perron *t*	−11.608***	.000
Augmented Dickey-Fuller *t*	−9.782	.000

***Significance level: ≤.01;
**Significance level: ≤.05.

5 | CONCLUSION AND POLICY SUGGESTIONS

Sustainable development has been put forward as a universal remedy to the three challenges of development applicable mostly for developing countries. The informal sector is relevant to sustainability issues since one of the SDGs promotes work and sustainable economic growth by supporting the policies of small businesses and labor-intensive sectors and by encouraging people to involve in sustainable production and consumption activities (UN, 2015). Getting motivated by this, the present study explored the impact of the informal activity on three dimensions of sustainable development: economy, environment, and social equity. Utilizing a global panel data set of

TABLE 7 The results of panel fixed effect and random effect regressions (Equations (2)–(5))

	(2) Composite index		**(3) Economic index**		**(4) Social index**		**(5) Environmental index**	
Variables/Models	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**	**FE**	**RE**
Informal	−0.057*** (5.752)	−0.001 (0.001)	−0.118*** (0.016)	−0.002 (0.002)	−0.022 (0.016)	0.001 (0.002)	−0.032* (1.880)	−0.001 (0.002)
Economic growth	0.029*** (3.101)	0.016** (0.008)	−0.011 (0.015)	−0.007 (0.012)	0.054*** (0.016)	0.029** (0.012)	0.046*** (2.880)	0.028** (0.012)
National expenditure	0.003 (0.562)	0.002 (0.002)	−0.010 (0.008)	0.001 (0.003)	0.001 (0.008)	0.001 (0.004)	0.018** (2.080)	0.004 (0.003)
Economic freedom	0.031*** (3.532)	0.003 (0.004)	0.007 (0.134)	−0.0004 (0.006)	0.055*** (0.015)	0.008 (0.006)	0.029** (2.010)	0.003 (0.005)
Constant	−1.089 (0.807)	−0.448 (0.324)	2.879** (1.275)	0.044 (0.523)	−2.945** (1.356)	−0.661 (0.533)	−3.202** (1.369)	−0.724 90.536)
Hausman test	48.47 (0.00)	—	34.14 (0.00)	—	17.69 (0.00)	—	14.23 (0.01)	—
No of groups	500	—	500	—	500	—	500	—
Observations	50	—	50	—	50	—	50	—
Heteroscedasticity (Breusch-Pagan)	0.50 (0.48)	—	0.22 (1.00)	—	8.35 (1.00)	—	18.27 (1.00)	—
F-statistic	1.05 (0.39)	—	1.102 (0.29)	—	0.44 (0.99)	—	0.36 (0.99)	—

Note: Std. errors of the variables are in parenthesis. For test results probability values are presented in parenthesis.
***≤.01;
**≤.05;
*≤.10.

TABLE 8 The results of FMOLS and DOLS

	FMOLS		DOLS	
Variables	**Coefficient**	***t*-statistic**	**Coefficient**	***t*-statistic**
Informal	−0.057***	−3.759	−0057***	4.183
Economic growth	0.056***	4.374	0.029***	2.256
National expenditure	0.005	0.700	0.003	0.409
Economic freedom	0.041***	3.460	0.030***	2.565
R-squared	0.089		0.111	
Wald χ^2	40.426***		20.208***	

***Significance level: ≤.01.

TABLE 9 The result of error correction model

Variables	Coefficient	*t*-statistic
ΔInformal	−0.028**	1.923
ΔEconomic growth	0.009*	1.886
ΔNational expenditure	−0.002	0.648
ΔEconomic freedom	0.008***	1.081
ECT_{t-1}	−0.131***	2.597
R-Squared	0.043	
S.E. of regression	0.369	
F-statistic	3.506***	
Durbin-Watson stat	1.669	

*≤.01;
**≤.05;
***≤.10.

50 developing countries that confront severe structural impediments to achieve sustainable development (UN, 2021), the study has constructed a synoptic composite index of sustainability (CIS), acknowledging that sustainability is a vast concept and is hard to capture in a single research. Applying the analysis of principal component (PCA) of the indicators considered under each aspect of sustainable development: economic, social, and environmental, the study constructs three individual indices, economic index of sustainability, social index of sustainability, and environmental index of sustainability. Then, a multivariate method of constructing the composite index has been followed to construct a composite index of sustainability where equal weights are assigned to each of the indices. This composite index is used to investigate the nexus of the informal sector to the sustainability of development of the selected developing countries. The nexus between the informal sector and each individual index has also been investigated in this study. The empirical results imply that informal economic activities impede achieving sustainable development. The results hold when the study controls for economic growth, national expenditure and economic freedom of countries.

Several empirical techniques have been employed to obtain the outcome of the informal sector- sustainable development nexus. Observing the presence of cross-sectional dependence, this study has employed second-generation unit root tests to check for data stationarity and then apply the Westerlund (2005) and the residual-based cointegration tests. The panel fixed effect (FE) model and random effect (RE) model are employed and the results of the estimated FE model are accepted due to its relevance over RE in this study as per the result of the Hausman test. The results of FE model project the empirical evidence of significant negative impact of the informal economic activities on the sustainability of development for the selected countries. Based on the cointegration test result, the long run information of the model has been extracted by applying FMOLS and DOLS. The results of the estimated cointegrated regression model validate the results of the FE model and finds those reliable for the long run in developing countries. Lastly, the ECM analysis results confirm the earlier outcomes and approve the gradual approach of these models towards the long-run equilibrium by projecting the negative sign and statistical significances of error correction term (ECT). The negative role of the informal sector on sustainability is a reminder of the need to address poverty, pollution, and economic deregulation issues indulged in the informal sector activities in developing countries. Therefore, the prescribed strategy is to reduce informality from business and other economic activities that limit the scope of the economies and to understand the domain through which interventions can be made to move towards a more formal economy.

The countries considered in this study are highly vulnerable to economic and environmental shocks and have low levels of human assets (UN, 2021). These are the basic reasons for subsistence employment and the spread of economic and business activities in informal arrangements in these countries. Other contributing factors are lack of efficiency and education of entrepreneurs, difficulties accessing credit, ineffective tax system, complex registration system. The spread of informality penalizes competition, promotes corruption and creates socio-economic and environmental issues. However, stringent measures to reduce the size of informal sector may lead to greater socio-economic fragility and can reverse by adverse economic shock since a large section of families and a significant portion of the economy depend on informal economic activities. Moreover, due to the linkage of the informal sector to the formal sector through subcontracting in the labor-intensive stages of production of the formal sector, the formal-informal relationship can be considered as complementary at a given level of government regulation, and attempts to expand or contract in one can influence the other in the same way (Arvin-Rad et al., 2010; La Porta & Shleifer, 2014). Therefore, strengthening the integration of informal economic activities into the

formal sector can be a good strategy to regulate the informal ones. Strategies for this can be widening the tax net, having respect to certain labor rules, cultural preparedness to produce for demanding markets where entrepreneurs will seek the benefit of pooling productive resources and associate with other producers for gaining access to the marketplace, practicing professionalism in production by maintaining timelines and quality. To facilitate the integration process enterprises in the informal sector should bring a cultural change by getting acquainted with ways and means of collective representation, such as joining to business and trade unions. The supply of educated entrepreneurs through proper training and expertise can also be a useful strategy to improve the scenario since educated entrepreneurs and managers can run the business proficiently.

An increase in economic growth of these countries can be an effective way to reduce informality and achieve sustainability. Due to economic growth and enhanced opportunity, demand will increase that inspires business and workers to move towards formal market-based operations. Fiscal and structural policies should be designed accordingly. A large-sized government that is consistent with enforcement effect and simplification of registration, and taxation policies can be encouraged as these can work negatively towards the growth of the informal sector. Ease of market entry cost, flexibility in entry requirements, and competitiveness in market mechanism can also be considered initial measures to attract firms towards formality. Countries should seek political solutions to the socio-economic and environmental adversities related to informality considering its dual nature. In all respects, economic policies should focus on strengthening the institutional quality of the countries to uphold overall economic freedom that will expedite a well-functioning economic system. Implementing corporate social responsibility (CSR) can be a good strategy to deduce into informal small business firms. The social dimension of sustainable development is represented by CSR and it can be viewed as an organization's contribution to sustainable development (Adeola et al., 2019; Bhagwat, 2011). Since CSR involves with diverse voluntary initiative apart from legal and contractual requirements that are absent in informal arrangements, its effective utilization can benefit workers and the local communities. Implementation of CSR will impose an obligation on informal businesses to pursue desirable policies that will add value to the society and will address adequately the changing relationship between business and society where informal activities are significantly visible. Availability of comprehensive information about CSR, orientation to CSR practices related to small and medium enterprises (SMEs), provision of training programs to educate on CSR themes (i.e., business ethics) can be helpful to promote CSR among informal firms and businesses.

Business in the informal sector has appeared to be a part of the economic development process in developing countries since the formal sector's crowding out of the informal sector is not unlikely. The informal sector bears a potential by opening economic opportunities through employment, social capital, a boost of local economies, supply of low-cost products. However, its negative contribution to technology and productivity, decent work condition and rights, employment protection, maintaining environmental quality, gaining fiscal revenue cannot be ignored. Sustainability policies are also often neglected by the business and firms operating under this sector. The findings of this study will put forward the demand for further investigation and assessment of informal sector business and economic activities to reassess the strategies of enterprises under this sector if sustainability of development is targeted to be achieved by the year 2030.

ACKNOWLEDGMENT

Open access publishing facilitated by University of Southern Queensland, as part of the Wiley - University of Southern Queensland agreement via the Council of Australian University Librarians.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

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ENDNOTE

[1] Algeria, Argentina, Bangladesh, Benin, Bolivia, Brazil, Burundi, Burkina Faso, Cabo Verde, Cameroon, Central African Republic, Chile, Colombia, Comoros, Congo, Costa Rica, Dominican Republic, Ecuador, El Salvador, Ethiopia, Gambia, Ghana, Guatemala, Guinea-Bissau, Haiti, Honduras, India, Indonesia, Kenya, Liberia, Mauritania, Morocco, Mozambique, Myanmar, Nigeria, Pakistan, Paraguay, Philippines, Rwanda, Senegal, Sri Lanka, South Africa, Thailand, Tunisia, Togo, Uganda, Uruguay, Vietnam, Zimbabwe, Zambia.

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How to cite this article: Sultana, N., Rahman, M. M., & Khanam, R. (2022). The effect of the informal sector on sustainable development: Evidence from developing countries. *Business Strategy & Development*, 1–15. https://doi.org/10.1002/bsd2.217