The moderating role of sustainable development goals in reviving the economy through green initiatives

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The Ukrainian economic crisis began with the start of the war and grew over time. This is because trade between countries was spread out because of problems with the supply chain. However, the energy sector in Ukraine is largely disturbed by this armed conflict. The purpose of this study was to test the impact of infrastructure damage, trade sanctions, the economic crisis, and energy investments in green energy in Ukraine through the lens of sustainable development goals (SGDs). The data is collected from the Ukrainian public, and the sample size for this research is 384. This research has used the structural equation modeling method by using Smart PLS 3 for data analysis. The findings of the study suggest that a green energy transition is possible when the Ukrainian government works on SDGs to manage the economic crisis and increases investments in the energy sector. The moderation of SGDs is considered a way forward for development in Ukraine. The novelty of this research is based on its framework, which is a new addition to a piece of knowledge. This research has extended knowledge by presenting new relationships related to the green energy transition. The limitations of this research are presented in conjunction with future directions that are a reliable way for scholars to contribute further to this area of research.

KEYWORDS

green energy transition, energy investments, trade sanctions, economic crisis, infrastructure damage, sustainable development goals

1 Introduction

The conflict between Russia and Ukraine is not limited to political boundaries; this conflict causes a variety of other societal setbacks (Mbah and Wasum, 2022). A bad economic situation in any country is possible when its aristocracy is involved in invading or fighting with other countries. The Russian invasion of Ukraine has presented the international community with a challenge because the consequences of war are never limited to the borders. The international community is also affected by the Russia-Ukraine conflict as the Ukrainian community is distrusted. A large number of infrastructures are damaged due to political conflict that results in an economic downturn (Gaio et al., 2022). The responsibility of the government is to develop and reliably work on infrastructure development.

Community development is possible when reasonable actions are taken according to the Sustainable Development Goals (SDGs). However, the fight between the Russian and Ukrainian armies damaged a lot of infrastructure, and community development became a secondary priority of the government (Davis, 2016). The start of this conflict has changed how the countries work together and how they trade with each other. In the case of Russia and Ukraine, it has changed how they trade with each other, and the political conflicts have become an economic conflict.

The economic crisis in Ukraine emerged over time with the outbreak of war, because the trade between different countries was disturbed due to issues related to the supply chain (Umar et al., 2022). These trade issues restricted the Ukrainian government's ability to get an appropriate supply of fuel for its energy sector. The development of the energy sector in Ukrainian territory is based on the traditional infrastructure system, which has been badly disturbed by the war. The armed conflicts result in blasts, and the infrastructure developed by the Ukrainian government for its energy supply is disturbed (Bin-Nashwan et al., 2022). Trade sanctions, on the other hand, are critical for the government because Russia's supportive countries limited their supply and imports with the Ukrainian government. This kind of conflict has led to an energy breakdown in the country (Adekoya et al., 2022). Undeniably, there was no backup system for the sustainability of infrastructure for the energy sector in Ukrainian territory. This challenge emerged over time as the war got worse and the armed conflict continued. The Russian attacks on major cities damaged several roads, buildings, and bridges that are vital to the country's trade and energy development (Abbassi et al., 2023). The energy plants were also damaged during the conflict by a Russian force and the counterforce of Ukrainian forces.

Developed countries have worked in the green energy sector to make sure that their countries use less energy. Adopting SDGs, which are needed to set the governments on the right path, will help the energy sector move forward (Ben Hassen and El Bilali, 2022). Rich countries have already shifted to the green energy sector, which is necessary for the development and sustainability of the environment. A sustainable environment in any country is necessary to enhance the living standard of the people, but this sustainability is ensured through the actions of the government (Khan et al., 2022a; Khan et al., 2022b; Shen and Hong, 2023). However, poor countries that are largely dependent on bad infrastructure for the development of goals related to sustainability are facing challenges in a time of economic crisis (Alam et al., 2022). Conflicts can be the future of any country, but sustainability is the only way to help countries work in a green way (Khan et al., 2023). If the Ukrainian government worked in a smart way, there would be less damage to the energy infrastructure as a result of the armed conflict (Yousaf et al., 2022). The literature related to the green energy transition in the context of Ukraine is limited. In this way, Nerlinger and Utz. (2022) reported that the Russia-Ukraine conflict appears not to entirely change the investors' assessment of a possible acceleration of a green energy transition. Furthermore, Saktiawan et al. (2022) reported that European countries have increased the budget for developing and using environmentally friendly energy to remove the dependence on gas and oil energy from Russia. Accordingly, Steffen and Patt. (2022) highlighted that Swiss public support for strong government policies is appropriate for clean energy policy. No doubt, these studies have contributed significant information to knowledge, but there is still a research gap in literature regarding the impact of infrastructure damage, trade sanctions, the economic crisis, and energy investment in relation to the transition to green energy. To add to the body of knowledge with important findings, the new information is needed.

Therefore, the purpose of this research is to test the impact of infrastructure damage, trade sanctions, the economic crisis, and energy investments in green energy transitions in Ukraine through the lens of SGDs. This research's scope is limited to the green energy transition in Ukraine. The novelty of this research is based on its framework, which is a new addition to a piece of knowledge. This research has used the structural equation modelling method for data analysis on responses collected by Ukrainian respondents. Theoretically, this research has extended knowledge by presenting new relationships related to green energy transitions. Furthermore, the moderation of SGDs is considered a way forward for development in Ukraine. As a result, this research has highlighted potential ways for the Ukrainian government to ensure green energy transitions in light of the SDGs. This research is based on a comprehensive literature review, a framework and hypotheses development. In line with this, the methodology of the study is also described before the data analysis section, and after the data analysis, the discussion and implications of the study are reported with future directions.

2 Review of literature

The Russian invasion of Ukrainian territories presented a different set of challenges. The energy crisis was also faced by the Ukrainian government when the economic crisis started and infrastructure was destroyed (Akter et al., 2011). This research has focused on the relationship between infrastructure damage, trade sanctions, the economic crisis, energy investments, and the green energy transition. Furthermore, the moderating influence of SDGs is also tested in this research model. However, the model of this research is available in Figure 1.

2.1 Hypotheses development

The damage to energy infrastructure is challenging for energy development in any country. The Ukrainian government faced challenges related to energy sector infrastructure damage (Gaio et al., 2022). The rich countries are working on infrastructure development on a large scale to enhance the capacity to produce energy at an appropriate level. The lack of reliability in the energy sector can make it challenging for the government to work on the energy sector and its advancement (Umar et al., 2022). The infrastructure for energy production and the supply of materials related to energy production need to be upgraded for a sustainable mission. The advancement of better infrastructure for energy can enhance the energy sector's development.

Trade sanctions are a challenge for any country trying to improve its public living standard (Davis, 2016). These trade sanctions can reduce imports and exports, which is a challenge
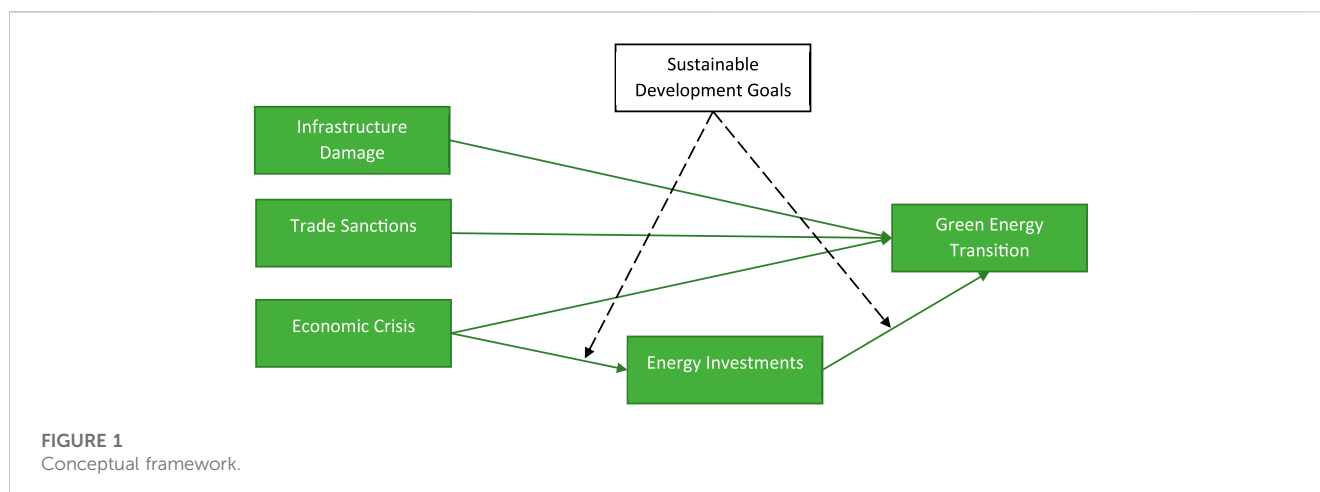
FIGURE 1
Conceptual framework.

for the energy sector. Furthermore, stable economies even face the consequences of trade sanctions and different kinds of economic crises. Better economic goals can be developed when a large investment in the energy sector is available in any country (Abbassi et al., 2023). Sanctions imposed by powerful countries or international organizations pose a challenge to the country's development. The Ukrainian energy sector faced trade-related problems when supply was affected by Russian aggression.

The economic crisis in Ukraine led to different kinds of challenges. The government of Ukraine faces different kinds of economic consequences when involved in armed conflict with Russia (Alam et al., 2022). The economic crisis also negatively affected the energy sector because the supply chain and other dimensions of work were at stake (Yousaf et al., 2022). The role of any government is to enhance its operations for the delivery of sustainable energy to the community. However, the case of Ukraine was different because the economy was affected due to war-related conflicts, and the sustainability of the work was badly affected to produce energy.

The economic crisis is not suitable for the working performance of any country. Investment in the energy sector can enhance the capacity of energy production in any country (Adekoya et al., 2022). Rich countries rarely face economic challenges, and they can bitterly develop their attitude towards the development of the energy sector. The reliability of the energy sector's efficiency is based on infrastructure development and better investment (Ben Hassen and El Bilali, 2022). However, Ukraine faced challenges related to the economy, and no firm was ready to invest in the energy sector to enhance its work to a higher level. Economic stability is possible with the foreign investment that is required in the energy sector of Ukraine.

Investment in the energy sector is a reliable way of working. Furthermore, investments in green energy have enhanced the efficiency and effectiveness of different countries work (Yousaf et al., 2022). The adaptability of the new vision for green energy is a reliable way to enhance the energy sector's capacity in any country. The developed world has megaprojects for energy sector transition. The availability of resources is hard to understand, and the development of the infrastructure sector advances (Ahmed et al., 2022). Moreover, the energy sector's reliable investment according to SDGs can boost the performance of the energy sector in any

country. The ability to invest is one of the most important things for improving the energy sector in Ukraine.

Investment in the energy sector is a reliable way of working. Those countries that have sustainability in their working practices have large foreign direct investments in green energy production. However, the conflicts between Russia and Ukraine led to an economic crisis in the country that was a challenge to the country's sustainable advancement (Khudaykulova et al., 2022). With economic stability, the reliability of the work for improving the advancement of the energy sector is possible. The availability of investments in the energy sector can enhance its performance to an advanced level with the sustainable development of the sector (Beraich et al., 2022). Accordingly, energy sector development is possible with the energy transition.

SDGs are used to improve the different sectors of government working for a better future. Sustainability in the economy is a possible way to improve the energy sector (Charap and Colton, 2018). However, investments in the energy sector should be based on sustainable development methods. The only way to help achieve goals in the energy sector is to ensure the long-term viability of investments. Less focus on SDGs can result in negative consequences because the smart goals are not met by the government to improve its performance productively (Charap and Colton, 2018). The availability of the goals and the workings of the government can be reliable when the economic situation is better in Ukraine.

The SDGs are to improve the environment through energy efficiency. The countries that have an appropriate focus on the development of the environment have reliable working attitudes (Bin-Nashwan et al., 2022). The availability of resources may be a more effective means of achieving SDGs in the energy sector. However, green investment is possible with the reliable work of the government in the energy sector. The Ukrainian government is required to influence foreign firms for smart investment in the green energy sector (Shen and Hong, 2023). The transition of energy from traditional to green modes can improve the workings of the Ukrainian government with less dependency on traditional energy production plants.

H1: There is a relationship between infrastructure damage and the green energy transition.

H2: There is a relationship between trade sanctions and the green energy transition.

H3: There is a relationship between the economic crisis and the green energy transition.

H4: There is a relationship between economic crisis and energy investments.

H5: There is a relationship between energy investments and green energy transition.

H6: There is the mediation of energy investments between the economic crisis and the green energy transition.

H7: There is a moderation of sustainable development goals between economic crisis and energy investments.

H8: There is a moderation of sustainable development goals between energy investments and green energy transition.

3 Methodology

3.1 Measurement development

The study is based on issues related to green energy transactions, but the context of this research is the war between Russia and Ukraine. The research that has already been done is looked at very carefully, and the measurements made by different studies are checked. But no scale was thought to be a good fit for this research because of the way it was used. Therefore, the scale development process is considered appropriate for this research. This process recommended by O'Brien and Toms. (2010) is used in the research for the development of the items. Furthermore, the existing literature is reviewed in detail, explaining the relationship between different variables in the conceptual framework. This literature is considered a reliable way to develop the scale. The definitions for each construct are taken, and the operationalization of the variables is also considered. Each key term is understood in its context, and the focus group discussion methodology is adopted for it. Hence, a pool of items based on a 7-point Likert scale is developed for each construct to determine the valid scale with a face validity test initially.

Experts from various universities were contacted to provide critical feedback on the scale items. In this way, the recommendations of the experts are used for scaled-down development. The modifications suggested by the experts are also considered in the scale development process. Furthermore, after the addition of all modifications and operationalization, including face validity, a data set on the scale is collected by 45 experts. This data is used for exploratory factor analysis to determine the scale items statistically. The statistical data initially approved the validity of the items, but six items achieved factor loadings less than 0.60. Therefore, these items were deleted. Furthermore, the validity of the scale is again confirmed by another group of experts, who

endorse the context and content of the scale as valid for data collection. However, the confirmatory factor analysis test is also conducted on a data set to investigate the correlation between the measurement scales. The results of the confirmatory factor analysis were also approved for scale validity. As a result, the study has developed six items: one for the economic crisis, five for energy investments, five for green energy transactions, five for infrastructure damage, six for sustainable development goals, and five for trade sanctions. The scale developed for this research is available in Table 1.

3.2 Data collection and statistical tool

The data for this research was collected from the respondents, who are citizens of Ukraine. On 1 January 2023, the United Nations estimated the Ukrainian population to be 34.1 million, with record low birth rates (United Nations Report, 2023). As the population is known and above 10, 000, 00, therefore, according to Krejcie and Morgan Table, the appropriate sample for this research is 384 (Krejcie and Morgan, 1970). However, 500 questionnaires were distributed for data collection because it is challenging to distribute 384 questionnaires exactly and collect data on them. The respondents were informed about the purpose of this research. They voluntarily participated in the data collection method. The demographic information of the respondents is confidential. However, 251 of them were women and 133 were men, belonging to different social statuses and age groups. However, the respondents' education was also different, but they were all educated. The total population of the study was known, but due to the unavailability of any sample frame, convenience sampling was utilized. Furthermore, the research has used the most recommended statistical tool, "Smart PLS 3.0." (Hair et al., 2012) for data analysis to determine the measurement model assessment, structural model assessment, and predictive relevance. This research is significant because it has developed the scale items and introduced the structural equation model in this area of knowledge.

4 Findings and data analysis

Skewness and kurtosis findings are used to assess data normality. The data is collected by coding the responses into Smart PLS 3.0. The skewness values for significant normality should not be greater than +1 or less than −1 (Bai and Ng, 2005). Accordingly, the kurtosis values for data normality should not be more than +1 or less than −1 (Kim and White, 2004). In this way, the research findings available in Table 2 and Figure 2 achieved a significant threshold for skewness and kurtosis values. As a result, the data collected for this study is normal and contains no missing values.

4.1 Convergent validity

The outcomes of convergent validity are used to test the reliability of the data. The factors considered for this test are

TABLE 1 Measurements.

Construct	Description
Economic Crisis	War leads to a critical economic crisis
	The country's economic crisis is hard to manage
	Political instability is a reason for the economic crisis
	The economic crisis is leading to inflation
	The Warzone area has a critical economic crisis
Energy Investments	Investment in the energy sector increased with time
	Investment in the energy sector is necessary for our country
	Green energy investment is necessary for the environment
	The government works fairly in energy sector investment
	The public and private sector investment in the energy sector is increased over time
Green Energy Transition	Our country needs green energy transactions
	Green energy transaction is possible with foreign direct investments
	Green energy transaction is safe for the environment
	Green energy transaction reduces the dependency on fuel
	Green energy is safe and easy to access
Infrastructure Damage	The infrastructure damage has challenged the development of our country
	A large number of infrastructures are damaged because of war conflict
	The infrastructure damaged by war has a challenge to society
	The damage to infrastructure has created many challenges for our government
	Infrastructure development costs a lot to rebuild it
Sustainable Development Goals	The sustainable goals implemented can enhance green energy
	Sustainability is possible with a timeline working for the energy sector
	The sustainability of the environment is ensured with green energy
	The government can implement sustainability goals fairly
	Sustainability-related goals are possible with a green environment
	Sustainable development can be increased by control over the environment
Trade Sanctions	Trade sanctions limit a country's economic growth
	Trade sanctions are a barrier to economic development
	The war conflict results in trade sanctions
	The sanctions on any country result in poverty
	Trade sanctions lead to chaos in the country

Cronbach's alpha, composite reliability, average variance extracted, and factor loadings. The factor loadings above 0.60 are significant (Peterson, 2000). Furthermore, the composite reliability of more than 0.70 is significant (Alarcón et al., 2015), and also Cronbach's alpha of more than 0.70 is significant (Taber, 2018). Accordingly, the average variance extracted values more than 0.50 are significant (Alarcón et al., 2015). The reported data in Table 3 and Figure 3 highlight that all the thresholds of significance were achieved by this research. Hence, the

reliability and validity indicators for this research data are achieved.

4.2 Discriminant validity

The discriminant validity of this research data is tested. Accordingly, the findings of Smart PLS are used for it. There are two different methods of discriminant validity tested in this research. Firstly, the cross-loading is tested, which is significant

TABLE 2 Normality test.

No.	Items	Missing	Mean	Median	Min	Max	Standard deviation	Excess kurtosis	Skewness
1	ID1	0	3.258	3	1	7	1.514	−0.453	0.091
2	ID2	0	3.276	3	1	7	1.762	−0.525	0.413
3	ID3	0	3.566	3	1	7	1.893	−0.805	0.302
4	ID4	0	3.534	3	1	7	1.901	−0.776	0.389
5	ID5	0	3.557	3	1	7	1.737	−0.496	0.311
6	TS1	0	3.511	4	1	7	1.807	−0.701	0.234
7	TS2	0	3.525	4	1	7	1.814	−0.858	0.134
8	TS3	0	3.710	4	1	7	1.873	−0.780	0.206
9	TS4	0	3.724	3	1	7	1.840	−0.721	0.315
10	TS5	0	3.674	3	1	7	1.932	−0.776	0.355
11	EC1	0	3.597	3	1	7	1.875	−0.710	0.369
12	EC2	0	3.606	3	1	7	1.860	−0.651	0.358
13	EC3	0	3.633	3	1	7	1.868	−0.746	0.296
14	EC4	0	3.538	3	1	7	1.763	−0.424	0.455
15	EC5	0	3.561	4	1	7	1.886	−0.880	0.185
16	EI1	0	3.484	3	1	7	1.814	−0.624	0.305
17	EI2	0	3.670	4	1	7	1.786	−0.624	0.267
18	EI3	0	3.054	3	1	7	1.482	−0.061	0.620
19	EI4	0	3.163	3	1	7	1.516	0.434	0.897
20	EI5	0	3.217	3	1	7	1.436	0.924	0.971
21	GET1	0	3.145	3	1	7	1.442	0.591	0.830
22	GET2	0	3.118	3	1	7	1.387	0.566	0.679
23	GET3	0	3.199	3	1	7	1.503	0.370	0.727
24	GET4	0	3.131	3	1	7	1.466	0.542	0.846
25	GET5	0	3.000	3	1	7	1.433	−0.227	0.464
26	SDG1	0	3.199	3	1	7	1.371	0.419	0.644
27	SDG2	0	3.127	3	1	7	1.453	0.125	0.615
28	SDG3	0	3.104	3	1	7	1.484	0.242	0.707
29	SDG4	0	3.213	3	1	7	1.419	−0.173	0.528
30	SDG5	0	3.127	3	1	7	1.376	0.249	0.599
31	SDG6	0	3.041	3	1	7	1.343	−0.152	0.512

when the loadings of any construct's indicators are greater than the loadings of other construct's indicators that are correlated with it (Li et al., 2020). The reported data in Table 4 and Figure 4 is accepted for cross-loadings.

Furthermore, the discriminant validity of the research data is tested using the heteritrait-monotrait (HTMT) method. The significance of discriminant validity is possible when the values taken by the HTMT model are less than 0.90 (Roemer et al., 2021). The reported data in Table 5 and Figure 5 show that this research also achieved the HTMT method of discriminant

validity. Hence, the data for this research has appropriate discriminant validity.

4.3 Structural equation model

The structural equation model is used for data analysis to test the path coefficients. The significance of path coefficients is checked with t > 1.96 and $p < 0.50$ (Hair et al., 2012). The results demonstrated that the impact of infrastructure damage on the
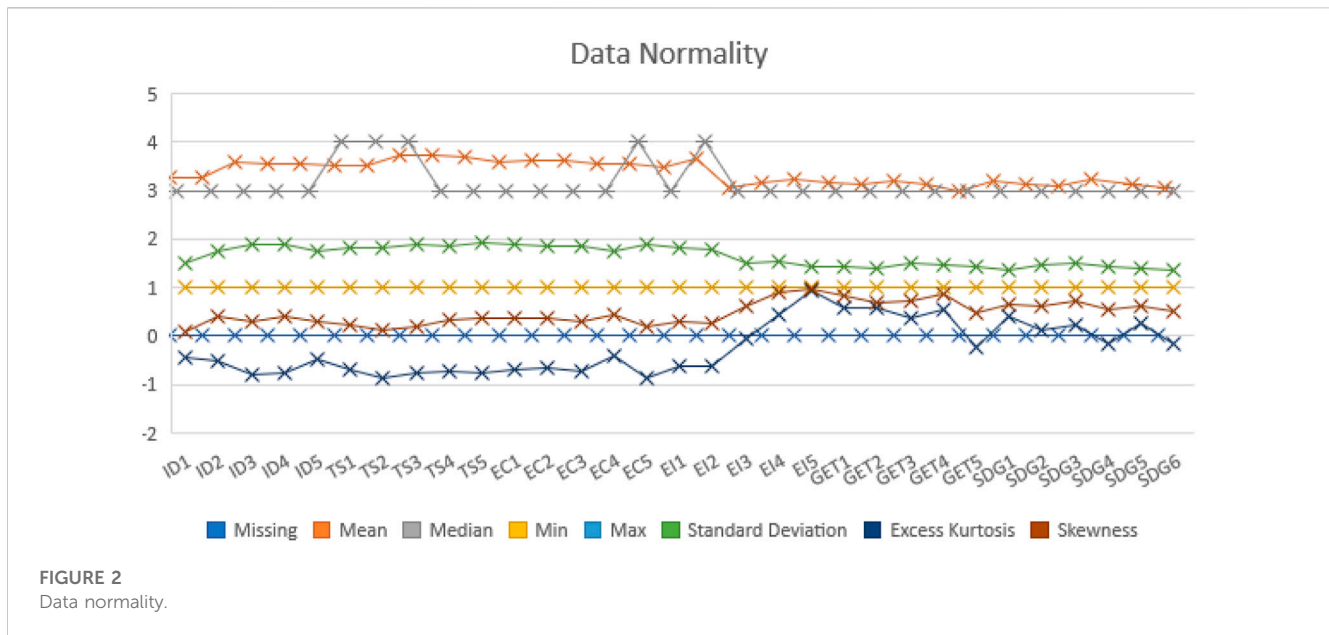
FIGURE 2
Data normality.

green energy transition is confirmed by "$p = 0$." Similarly, the results demonstrated that the impact of trade sanctions on the green energy transition is confirmed by "$p = 0$." Furthermore, the results demonstrated that the impact of the economic crisis on the green energy transition is confirmed by "$p = 0$." Accordingly, the results demonstrated that the impact of trade sanctions on energy investments is confirmed by "$p = 0$." Likewise, the results demonstrated that the impact of energy investments on the green energy transition is confirmed by "$p = 0$." The mediation of energy investments is confirmed between the economic crisis and the green energy transition with "$p = 0$." However, the moderation of SDGs is confirmed between the economic crisis and energy investments: "$p = 0.046$." In this way, the moderation of SDGs positively strengthens the relationship between the economic crisis and energy investments. The results of this moderating hypothesis are also highlighted in Figure 6. Meanwhile, the moderation of SDGs between energy investments and green energy transition is rejected: "$p = 0.786$." The data for these paths are reported in Table 6 and Figure 7.

4.4 Predictive relevance

The model strength and predictive relevance are tested with Q^2. The PLS Predictive Relevance tool is used for this finding. The significance of predictive relevance is ensured when the Q^2 is greater than 0 (Akter et al., 2011). The reported data in Table 7 and Figure 8 demonstrated that this study has 66% predictive relevance, which is strong. Hence, the model of this research has appropriate predictive relevance.

5 Discussion

The study objective is significantly achieved by its findings related to the green energy transition. However, the findings of

this study are novel in terms of knowledge and literature. The research hypotheses based on different paths are tested with a structural equation model. The relationship based on H1 between infrastructure damage and green energy transactions is confirmed. Furthermore, the existing literature also supports this hypothesis. Any country's efforts to improve its energy industry face difficulties due to damage to the energy infrastructure (Abbassi et al., 2023). The destruction of the infrastructure in the energy industry presented difficulties for the Ukrainian administration. Wealthy nations are investing heavily in infrastructure development to increase their ability to produce energy at the proper level (Ben Hassen and El Bilali, 2022). It may be difficult for the government to focus on the energy sector's advancement given its declining reliability. It is essential to modernize the energy production infrastructure and the supply of materials associated with energy production to achieve sustainability. The development of the energy sector may be aided by the advancement of better infrastructure.

Accordingly, the relationship based on H2, between trade sanctions and green energy transactions is confirmed. Also, the existing literature supports this hypothesis. The trade sanctions make it difficult for any nation to raise the standard of living for its people. These trade penalties may lessen imports and exports, which might be problematic for the energy sector (Yousaf et al., 2022). The effects of trade sanctions and other economic crises are also felt in stable economies. When significant investment in the energy industry is available in every nation, greater economic goals can be developed (Davis, 2016). The imposition of sanctions by strong nations or any organization of nations is a difficult path for a country's progress. commercial issues in the Ukrainian energy sector when Russian aggression impacted supply.

Thirdly, the relationship based on H3 between the economic crisis and green energy transactions is confirmed. Still, the existing literature also supports this hypothesis. Ukraine's financial downturn brought up a variety of difficulties. When engaged in armed combat with Russia, the Ukrainian government faces a variety of economic repercussions (Umar et al., 2022). Since the

TABLE 3 Convergent validity.

Construct	Items	Factor loadings	Cronbach's alpha	Composite reliability	Average variance extracted
Economic Crisis	EC1	0.908	0.942	0.956	0.813
	EC2	0.887			
	EC3	0.922			
	EC4	0.897			
	EC5	0.894			
Energy Investments	EI1	0.787	0.894	0.922	0.703
	EI2	0.777			
	EI3	0.857			
	EI4	0.892			
	EI5	0.872			
Green Energy Transition	GET1	0.900	0.943	0.955	0.779
	GET2	0.911			
	GET3	0.930			
	GET4	0.933			
	GET5	0.899			
Infrastructure Damage	ID1	0.904	0.941	0.955	0.808
	ID2	0.904			
	ID3	0.911			
	ID4	0.891			
	ID5	0.883			
Sustainable Development Goals	SDG1	0.876	0.951	0.962	0.837
	SDG2	0.891			
	SDG3	0.863			
	SDG4	0.913			
	SDG5	0.873			
	SDG6	0.880			
Trade Sanctions	TS1	0.924	0.947	0.959	0.825
	TS2	0.906			
	TS3	0.898			
	TS4	0.897			
	TS5	0.915			

supply chain and other aspects of work were in jeopardy, the economic crisis also had a detrimental impact on the energy industry. Any government's job is to optimize operations so that the community can receive sustainable energy (Charap and Colton, 2018). But the situation in Ukraine was different because of the war, which hurt the country's economy and made it much harder for the energy production industry to work.

Fourth, the relationship between H4 and energy investments during the economic crisis is proven to be true. Furthermore, the existing literature also supports this hypothesis. No country's

productivity can be supported by the current economic situation. Any country's capability for energy production can be increased by investments in the energy sector (Beraich et al., 2022). Rich nations rarely experience economic hardships, and as a result, their attitudes toward the growth of the energy sector might become harsh. Infrastructure development with better investment is the foundation for the energy sector's dependability and effectiveness (Charap and Colton, 2018). Although Ukraine was experiencing economic difficulties, no company was willing to invest in the energy sector to raise the sector's productivity. Ukraine's energy sector,
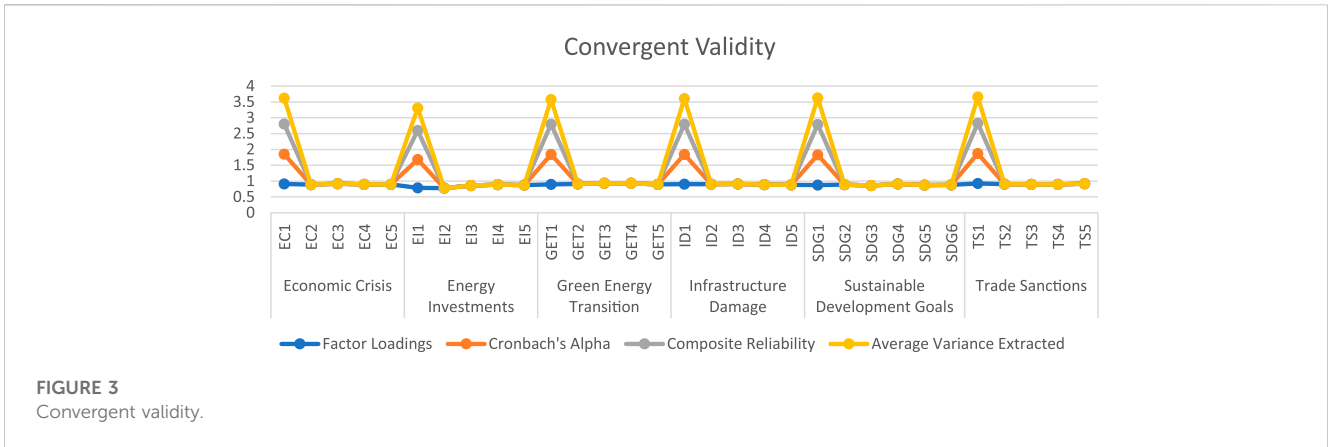
FIGURE 3
Convergent validity.

TABLE 4 Cross loadings.

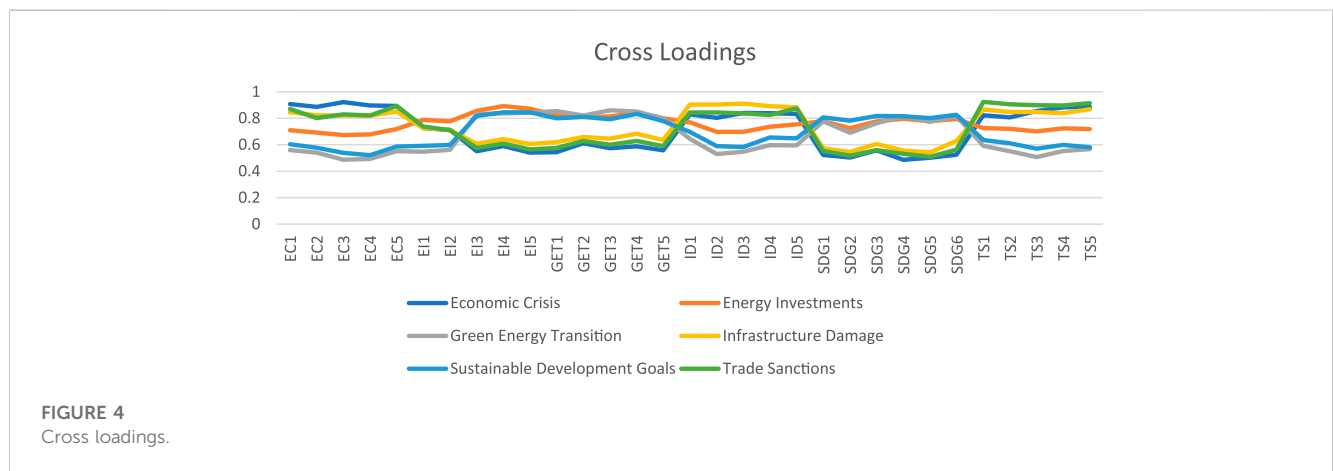| Construct	Economic crisis	Energy investments	Green energy transition	Infrastructure damage	Sustainable development goals	Trade sanctions
EC1	**0.908**	0.710	0.560	0.845	0.603	0.870
EC2	**0.887**	0.692	0.541	0.823	0.578	0.801
EC3	**0.922**	0.673	0.487	0.820	0.538	0.830
EC4	**0.897**	0.678	0.492	0.819	0.521	0.820
EC5	**0.894**	0.718	0.551	0.850	0.586	0.894
EI1	0.725	**0.787**	0.548	0.725	0.592	0.738
EI2	0.711	**0.777**	0.562	0.713	0.598	0.709
EI3	0.551	**0.857**	0.834	0.607	0.817	0.576
EI4	0.590	**0.892**	0.836	0.643	0.845	0.610
EI5	0.541	**0.872**	0.842	0.606	0.845	0.565
GET1	0.544	0.822	**0.854**	0.620	0.799	0.575
GET2	0.611	0.810	**0.821**	0.658	0.811	0.629
GET3	0.573	0.814	**0.860**	0.647	0.793	0.601
GET4	0.588	0.838	**0.851**	0.684	0.833	0.629
GET5	0.558	0.799	**0.800**	0.635	0.779	0.589
ID1	0.829	0.770	0.645	**0.904**	0.697	0.844
ID2	0.804	0.698	0.529	**0.904**	0.590	0.843
ID3	0.840	0.697	0.547	**0.911**	0.582	0.837
ID4	0.838	0.737	0.597	**0.891**	0.655	0.824
ID5	0.833	0.754	0.595	**0.883**	0.648	0.876
SDG1	0.523	0.778	0.776	0.572	**0.806**	0.553
SDG2	0.504	0.726	0.691	0.546	**0.782**	0.517
SDG3	0.558	0.777	0.763	0.605	**0.818**	0.560
SDG4	0.486	0.797	0.813	0.556	**0.816**	0.531
SDG5	0.502	0.778	0.773	0.542	**0.801**	0.509
SDG6	0.525	0.795	0.818	0.628	**0.826**	0.564

TABLE 4 (*Continued*) Cross loadings.

Construct	Economic crisis	Energy investments	Green energy transition	Infrastructure damage	Sustainable development goals	Trade sanctions
TS1	0.822	0.726	0.591	0.867	0.636	**0.924**
TS2	0.806	0.721	0.551	0.848	0.611	**0.906**
TS3	0.854	0.700	0.506	0.848	0.571	**0.898**
TS4	0.883	0.724	0.553	0.838	0.599	**0.897**
TS5	0.887	0.719	0.566	0.869	0.581	**0.915**

Bold values indicates the factor loading of same construct.

FIGURE 4
Cross loadings.

TABLE 5 HTMT.

Construct	Economic crisis	Energy investments	Green energy transition	Infrastructure damage	Sustainable development goals	Trade sanctions
Economic Crisis						
Energy Investments	0.861					
Green Energy Transition	0.619	0.794				
Infrastructure Damage	0.778	0.706	0.688			
Sustainable Development Goals	0.662	0.656	0.666	0.746		
Trade Sanctions	0.699	0.681	0.645	0.696	0.596	

which is important for the country's economy, needs money from outside the country.

According to H5, there is a link between energy investments and transactions that use green energy. Furthermore, the existing literature also supports this hypothesis. Participation in the energy industry is a reliable method of operation. Additionally, the effectiveness and efficiency of various nations' efforts have increased thanks to investments in green energy (Khudaykulova et al., 2022). A proven technique to increase the capacity of any nation's energy sector is through the flexibility of the new vision for green

energy. Megaprojects for the transformation of the energy industry exist in wealthy nations. It is difficult to comprehend why resources are less accessible and why the infrastructure industry is developing more quickly (Karolewski and Cross, 2017). Additionally, consistent investments in the energy sector following the SDGs can improve the performance of the sector in any nation. The improvement of Ukraine's energy sector depends critically on the availability of investment resources.

The mediation relationship based on H6 is also accepted, as is the mediation of energy investments between the economic crisis
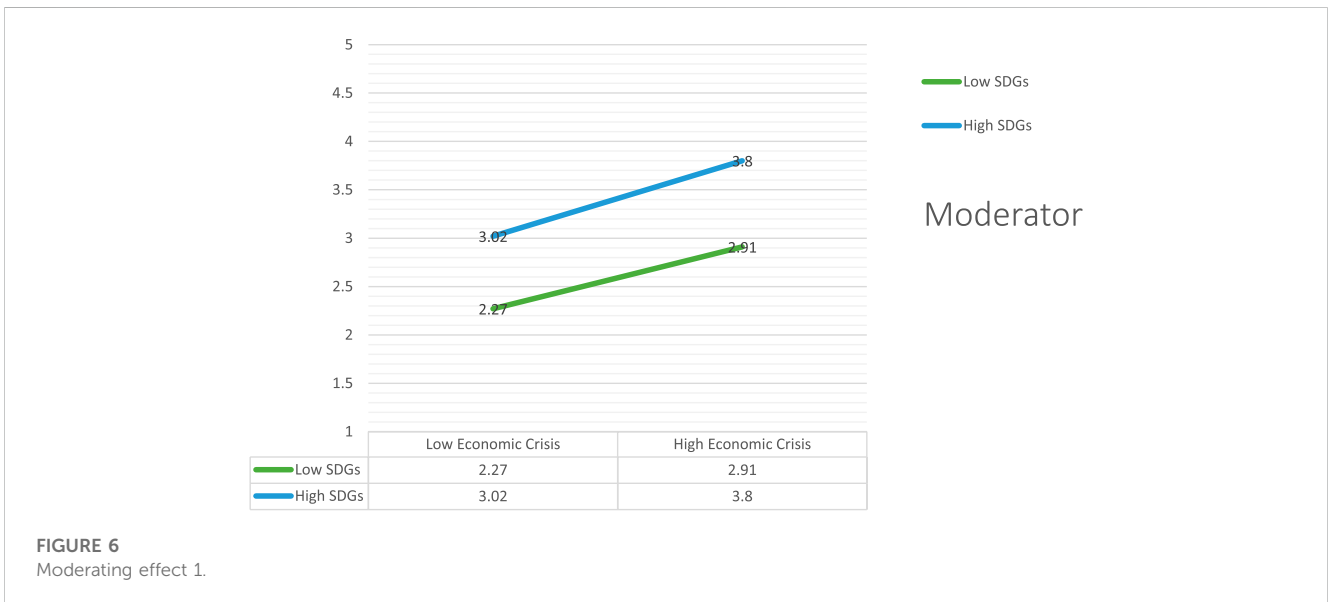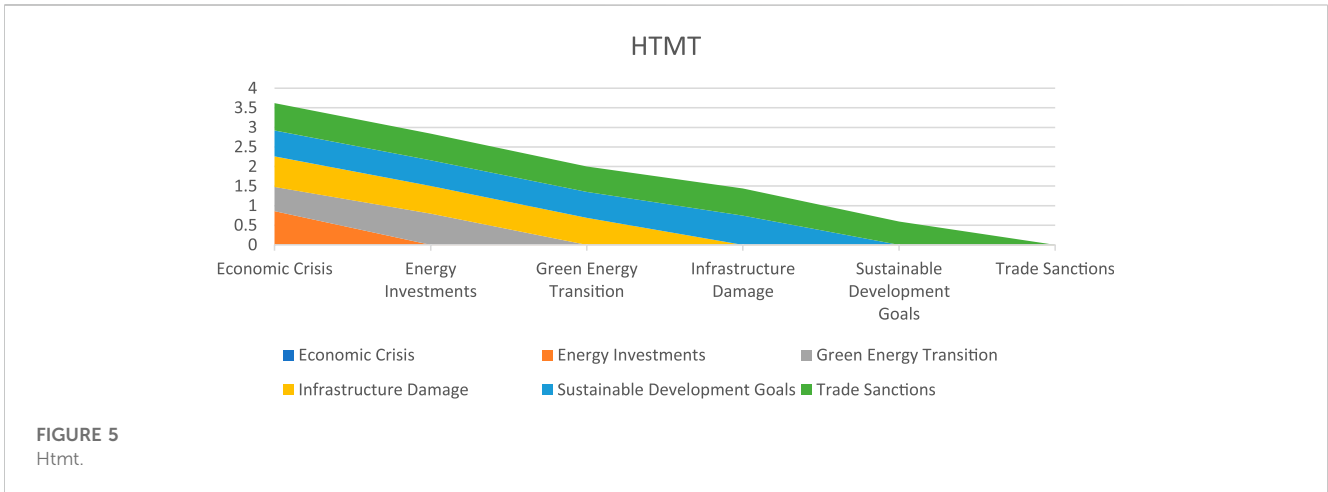
FIGURE 5
Htmt.

FIGURE 6
Moderating effect 1.

TABLE 6 Path coefficients.

Hypothesis	Relationship	Original sample	Standard deviation	T statistics	p values
1	Infrastructure Damage -> Green Energy Transition	0.637	0.042	15.127	0
2	Trade Sanctions -> Green Energy Transition	0.614	0.066	9.305	0
3	Economic Crisis -> Green Energy Transition	0.292	0.071	4.103	0
4	Economic Crisis -> Energy Investments	0.355	0.033	10.87	0
5	Energy Investments -> Green Energy Transition	0.458	0.094	4.888	0
6	Economic Crisis -> Energy Investments -> Green Energy Transition	0.163	0.029	5.537	0
7	Moderating Effect 1 -> Energy Investments	0.035	0.017	2.002	0.046
8	Moderating Effect 2 -> Green Energy Transition	0.008	0.028	0.272	0.786

and green energy transactions. Indeed, this relationship is new to our knowledge, but the existing studies support it (Adekoya et al., 2022). The most reliable method of operation is to invest in the

energy sector. Sustainability-oriented nations receive significant foreign direct investments for the generation of green energy. However, the hostilities between Russia and Ukraine caused an
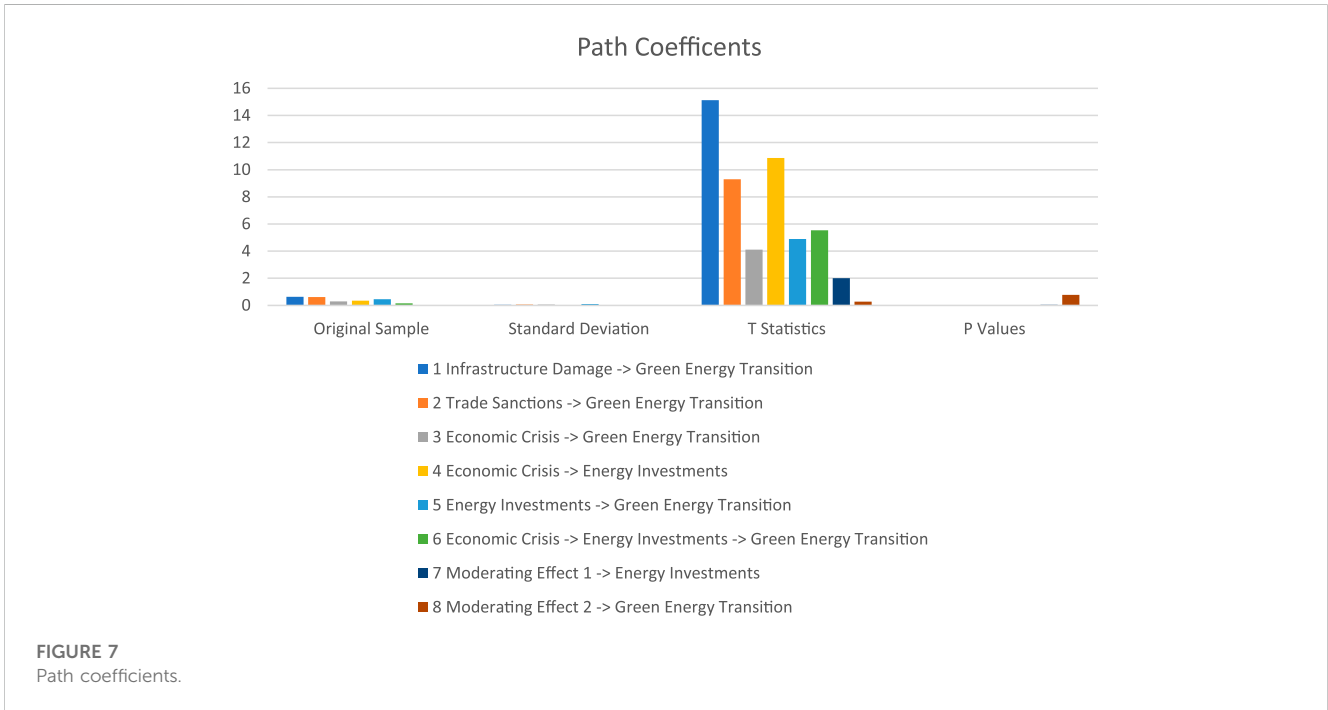
FIGURE 7
Path coefficients.

TABLE 7 Predictive relevance.

Construct	SSO	SSE	Q² (=1−SSE/SSO)
Economic Crisis	1,105	1,105	
Energy Investments	1,105	433.269	0.608
Green Energy Transition	1,326	442.637	0.666
Infrastructure Damage	1,105	1,105	
Moderating Effect 1	221	221	
Moderating Effect 2	221	221	
Sustainable Development Goals	1,105	1,105	
Trade Sanctions	1,105	1,105	

FIGURE 8
Predictive relevance.
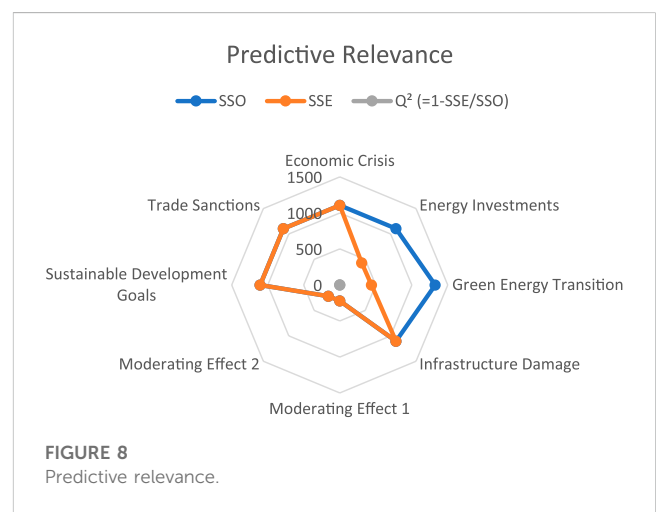
economic crisis in the nation that made it difficult for the country to progress sustainably (Ahmed et al., 2022). With economic stability, it will be more reliable to work towards enhancing the energy sector's advancement. With the growth of the energy industry in a sustainable fashion, the availability of investments can advance its performance to a higher level. As a result, the energy transition makes the development of the energy industry possible.

Additionally, the moderation relationship based on H7 is also accepted, and the moderation of SDGs between economic crisis and energy investments is also confirmed. This relationship is certainly novel, but existing research backs it up. The SDGs are utilized to strengthen the various government departments striving for a brighter future (Shen and Hong, 2023). Improving the energy sector may be achievable through economic sustainability. However, sustainable development methods should be the

foundation for all energy sector investments. The only method that can assist in achieving objectives in the energy sector is the dependability of investments made sustainably (Alam et al., 2022). Less attention paid to the SDGs could have a negative impact because the government would not be able to achieve the smart goals that would have helped it enhance its performance. When Ukraine's economic situation is better, the goals' accessibility and the government's operation can be trusted.

However, the moderation relationship based on H8 is not accepted, and the moderation of SDGs between energy investments and green energy transactions is rejected. The SDGs call for increased energy efficiency to improve the environment (Gaio et al., 2022). Countries with good work ethics are those that put the right amount of focus on the

development of the environment. In the energy industry, it may be easier to reach the SDGs if we have the resources to do so. However, green investments are feasible because of the government's dependable performance in the energy industry (Bin-Nashwan et al., 2022). The Ukrainian government must persuade international businesses to make wise investments in the green energy industry. By switching from traditional to green ways of making energy, the Ukrainian government can run more efficiently because it will not have to rely as much on traditional energy sources.

6 Conclusion

In a nutshell, this research showed that it is the Ukrainian government's job to build infrastructure in a way that is sustainable. Also, this kind of infrastructure growth is possible if the Ukrainian government takes reasonable steps to help with the transition to green energy. In the same way, this research found that the transition to green energy is possible if the Ukrainian government works on the Sustainable Development Goals (SDGs) to deal with the economic crisis and get more money invested in the energy sector. Indeed, a responsible government can work in a fair way to remove all kinds of trace barriers. So, the Ukrainian government can work toward a green energy transition by improving infrastructure, making the economy better, and investing in energy.

7 Implications, limitations, and future directions

The novelty of this research is based on its framework, which is a new addition to knowledge. This research has extended knowledge by presenting new relationships related to green energy transactions. The moderation of SGDs is considered a way forward for development in Ukraine. This research has contributed to the knowledge that the green energy transition is influenced by infrastructure damage, the economic crisis, trade sanctions, and energy investments. Furthermore, this research revealed the mediation relationship of energy investments between the economic crisis and green energy transactions. Accordingly, this research has enhanced the literature on the moderating relationship of SDGs with economic crises and energy investments. These additions to the body of knowledge are novel contributions to this research. Furthermore, this research has reliable practical implications for the Ukrainian government to improve its work on green energy transactions. The study demonstrated that the Ukrainian government is required to work on the implementation of SDGs and that the green energy investment method should be adopted for it.

Foreign direct investment in green energy can help improve the performance of government departments and keep the energy sector's progress going for a long time. So, the government of Ukraine has to build infrastructure for the energy sector in a green way so that the community might be able to use green energy. Also, the Ukrainian government needs to figure out how to deal with the economic crisis in a way that will work for the long term. This research has certain limitations that are required to be addressed by future studies. Initially, the study developed a scale that was new in nature and considered valid for this research through confirmatory factor analysis and exploratory factor analysis. However, the scholars are required to test this scale with another set of samples to determine its further validity. Accordingly, the model developed by this research has determined different factors for green energy transactions, but it has not considered the factor of foreign direct investment in this model. Therefore, the scholars are wishing to determine the impact of foreign direct investment on green energy transactions in Ukraine. As a result, scholars will address these limitations of this research in future research works.

Data availability statement

Data associated with this study is available from the corresponding author upon a reasonable request.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The study did not involve humans as subjects. However, the participants were informed and consent was obtained before data collection.

Author contributions

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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