The Role of Innovation Adoption and Circular Economy Readiness on the Environmental Sustainability: Moderating Impact of Organizational Support

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Environmental sustainability is currently the most critical demand on a global scale, and it may be reached through innovation and a circular economy. This component demands the aim of policymakers and researchers. Therefore, this study investigates the effect of innovation adoption and circular economy readiness on Peru's environmental sustainability. The research also examines the moderating effect of organizational support on innovation adoption, preparation for the circular economy, and environmental sustainability in Peru. Using questionnaires, the researchers collected and evaluated the data using smart PLS. The results demonstrated a positive relationship between innovation adoption, circular economy readiness, and environmental sustainability in Peru. The results also demonstrated that organizational support moderates' innovation uptake, preparation for the circular economy, and environmental sustainability in Peru. The research aids policymakers in formulating environmental sustainability strategies based on innovation uptake and circular economy preparedness.

Key words: Innovation adoption, circular economy readiness, environmental sustainability, organizational support, Peru.

1. INTRODUCTION

Environmental deterioration will continue to be one of the world's most significant problems, both now and in the future. The dreadful effects of the environment portend a bleak future. This is an example of global warming. Global warming has both a financial and a health impact on the world. The same is valid for Peru. Peru is one of the most biodiverse countries in the world due to its extensive coastline, Andean highlands, and Amazonian environments. However, this abundance is threatened by alterations in precipitation and temperature. El Nio Southern Oscillation exacerbates the frequency, intensity, and effects of natural disasters such as floods, droughts, and landslides in Peru. Climate change and increasing unpredictability will further amplify these effects (Ziegler-Rodriguez et al., 2019). These climate challenges threaten Peru's recent development gains, particularly with ongoing problems such as agricultural expansion, deforestation, illegal mining, and air and water pollution. Land use change and forestry account for over half of the nation's total greenhouse gas emissions, followed by energy and agriculture. The overexploitation and degradation of Peru's natural resources are the underlying causes of the country's environmental difficulties (Tarazona et al., 2020). Mining, oil and gas production, and illegal logging are problematic industries (Tarazona et al., 2020). There is still much work to be done.

Exploration for oil and gas in the Amazon has caused deforestation, land and water degradation, and the displacement of traditional inhabitants (Masron et al., 2019). By searching for oil and gas in distant regions, producers jeopardize the natural equilibrium of these pristine ecosystems. Pipeline development may pose a substantial danger to biodiversity due to the destruction of habitats. Mining is a problem in Peru since it has caused serious water contamination. All these metals are extracted in Peru, contaminating the water systems of the Cordillera Huayhuash and central Peru. As of 2009, three big gold mines in southern Peru's Madre de Dios region had devastated a total of 38,300 acres (15,500 hectares) of forest (Tyagi et al., 2014). Numerous smaller mines, which account for at least half of the gold mining in this region, have begun to negatively impact the environment by poisoning the water supply and accelerating deforestation. Population growth is the primary source of many of Peru's environmental challenges (Alvarado et al., 2017). Both overgrazing and frequent tree cutting for fuel contribute to soil erosion and mudslides. Adopting modern-era innovation and promoting a circular economy are two ways to mitigate environmental degradation and bring about environmental sustainability (Adebayo et al., 2021; Skoczinski et al., 2021; Usman et al., 2020). However, the country's support and organization are the most critical factors (Soewarno et al., 2019), as hazardous gas emissions are one of the leading drivers of global environmental degradation. Figure 1 depicts the carbon output in Peru (in thousand tons).

Although environmental sustainability, innovation adoption, and circular economy have been studied from diverse vantage points and at different times, their research has not yet achieved its zenith, as many of their facets remain to be investigated. 2) Chege et al. (2020) examined the relationship between technological innovation and the performance of small and medium-sized enterprises (SMEs) through environmental sustainability in Kenya.
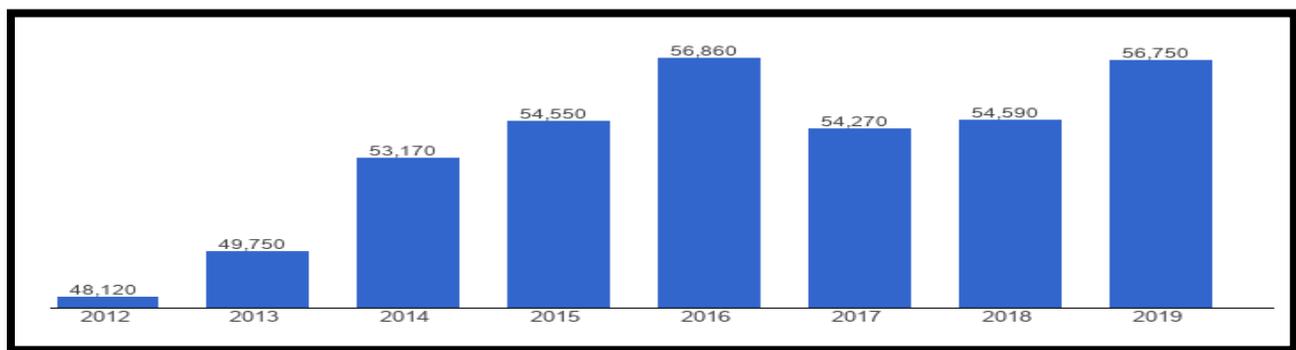

Figure 1: Carbon emission in Peru (in thousand tons)

Source: Global Economy

The current study will also examine this relationship, adding variables such as the circular economy and organizational support in Peru and a new data set. 3) The paradigm of environmental sustainability, innovation adoption, circular economy, and organizational support has not been tried in Peru in recent years. 4) Hashmi et al. (2019) examined whether there is a relationship between environmental sustainability, innovation, and economic growth. The current study will also focus on environmental sustainability and innovation by employing the moderating effect of organizational support with a new sample set. 5) Joensuu et al. (2020) conducted a systematic review of circular economy practices in the building environment. In contrast, the current study will empirically examine the relationship between circular economy and environmental sustainability with a moderating effect in Peru, utilizing a new data set. 6) Yang et al. (2022) did a literature analysis on the strategies of the circular economy to alleviate the

negative effects of climate change; however, the current study will empirically examine the link with the addition of a new variable, innovation adoption, using a new data set. 7) Boudreaux et al. (2019) investigated the moderating role of organizational support in the relationship between social traits and entrepreneurship; however, the present study examines its moderating effect on innovation adoption, circular economy, and environmental sustainability in Peru using a new data sample. Environmental sustainability, one of the topics of the modern era, will be highlighted in the context of circular economy and innovation with an eye toward the next generation (Sumarno et al., 2021). The study will also contribute to the literature on environmental sustainability and provide a guideline and assistance to environment-related professionals in reviewing and enhancing their practices. 3) Although various aspects of environmental sustainability have been investigated too far, many remain unexplored; therefore, the present inquiry will also aid scholars in exploring new aspects.

2. LITERATURE REVIEW

In recent decades, environmental sustainability has received much attention. There are various reasons for this, including environmental deterioration, increased carbon and greenhouse gas emissions, and their negative impact on human existence, especially health. The global community is very interested in this topic and favors projects that contribute to environmental sustainability. Utilizing modern technical innovation, such as for producing energy from natural resources, the technological advancements of the modern age are also crucial. There is a strong correlation between the acceptance of innovations and environmental sustainability. In this context, Hysa et al. (2020) examined the notion of circular economy innovation, environmental sustainability, and economic growth. The research focused on the indices of innovation in the circular economy, economic growth, and environmental sustainability. The study reviewed 295 papers on the circular economy, 59464 pieces on sustainability, and 67 articles on the intersection of economics and sustainability. The papers analyzed span the years 1950 to 2016. The investigation determined a substantial relationship between all of the chosen factors.

Additionally, circular economy, innovation, and environmental sustainability impact economic growth. Due to their membership in all levels of society, SMEs are a crucial component of any nation's economy, mainly the mediocre grades. Additionally, technological innovation can improve their function and benefit the environment. Chege et al. (2020) explored the relationship between technological innovation and small and medium-sized enterprises (SMEs) performance via environmental sustainability. In Kenya, the investigation was conducted. The study was exploratory. The research sampled 204 Small and Medium-Sized Businesses. Utilizing online surveys, the sample was obtained. The collected sample was analyzed using a regression model. Specifically in Kenya, the analysis demonstrated a significant relationship between innovation uptake and environmental sustainability. Hashmi et al. (2019) also explored the relationship between environmental sustainability, innovation, and economic growth. The investigation was conducted on OECD nations. The study was exploratory. The research sampled fifteen individuals. Questionnaires were utilized to acquire the sample. Using STIRPAT, the collected material was examined. The analysis indicated a substantial relationship between innovation, environmental legislation, and economic development. In addition, a 1% increase in environmental tax revenue per capita reduces carbon emissions by 0.03%, while a 1% increase in environmentally beneficial patents reduces carbon emissions by 0.017%. Thus, the hypotheses drawn from the preceding discussion are as follows.

H1: There is a significant association between Innovation Adoption and Environmental Sustainability.

The concept of environmental sustainability has garnered much attention in recent decades. Several causes contribute to it, including environmental deterioration, an increase in carbon and greenhouse gas emissions, and the harmful consequences of these variables on human life, particularly on health. (Oláh et al., 2020) The international community is interested in this field and favors projects that contribute to environmental sustainability. Modern technological developments, such as the ability to generate energy from reclaimed materials, also play a significant role in this field. The circular economy is based on the concept of recycling. Renewable energy is a prime example of the circular economy.

The global ecology is deteriorating due to excessive carbon emissions; thus, the globe is adopting the circular economy concept and shifting to renewable energy (Iqbal, 2020). The circular economy is founded on recycling, and renewable energy is generated from similar resources, such as water and air, without emitting harmful gases. This entire procedure results in a stable global ecosystem. A significant correlation exists between circular economy and environmental sustainability. In this regard, Joensuu et al. (2020) undertook a comprehensive assessment of circular economy techniques in environmental construction. The nature of the inquiry was exploratory. The inquiry studied 282 articles from numerous periodicals. This article comprehensively analyzes the most recent scholarly studies on circular economies (CE) and the built environment. It is also predicated on the notion that a substantial fraction of all sustainability challenges might be remedied if CE was implemented due to the built environment's significant environmental impact. The review determined that circular economy methods are crucial to environmental construction. Shojaei et al. (2021) aimed to facilitate the built environment in a circular economy. The analysis indicated that the circular economy is crucial to the overall built environment process. As there is a need for methods to implement a circular economy across all sectors, the circular economy

is strongly linked to environmental sustainability regarding climate change. These causes have also contributed to a rise in solid waste and climate change. In this context, Yang et al. (2022) developed circular economy techniques that reduce the negative effects of climate change and promote environmental sustainability. Changing land use and land cover to accept more bio-based products is difficult, according to the research assessment. Carbon dioxide removal technologies cost between $100 to $1,200 per ton of carbon dioxide. A tiny number of companies have political goals relating to climate change. Although circular economy concepts can be implemented in numerous industries, including waste management, energy production, building, and transportation, life cycle analysis is still required to optimize new systems. Therefore, the hypothesis drawn from the preceding discussion is as follows:

H2: There is a significant association between Circular Economy Readiness and Environmental Sustainability.

The environment has become an integral aspect of the future of the globe. Due to its dreadful repercussions, the environment is a fundamental concern for all nations. On the one hand, the global environment is deteriorating due to a growth in the emission of dangerous gases, such as carbon dioxide and greenhouse gases, as well as the consumption of fossil fuels and the generation of energy from traditional resources, such as coal. On the other hand, the globe is increasingly researching it to adopt innovation that helps alleviate the hazardous impacts of environmental deterioration. In this context, innovation is crucial, as the production of electric cars reduces fuel consumption and carbon emissions. In the entirety of the procedure, organizational support is an essential aspect. In this regard, Gilal et al. (2019) examined whether organizational support can moderate the relationship between environmental performance and green human resources management. The investigation was conducted on institutes of higher education. The study sampled the information of 214 higher education institution personnel. The collected sample was analyzed with the assistance of SPSS. The analysis indicated that there is a statistically significant relationship between all factors.

Additionally, organizational support moderates the relationship significantly. Likewise, Garavan et al. (2021) examined the moderating influence of organizational support on the link between training and organizational performance. According to the analysis results, all investigation factors are highly connected. Additionally, organizational support serves as a significant moderator. Thus, the hypothesis drawn from the preceding discussion is as follows:

H3: Organizational Support significantly moderates the association between Innovation Adoption and Environmental Sustainability.

Shortly, environmental deterioration will be one of the world's most significant dangers. The global temperature

is rising at an accelerated rate. Temperature rise is an obvious indication of global warming. This global warming contributes to the loss of natural resources through the melting of glaciers and the consumption of coal, gas, and oil. There are a lot of causes for this global warming, including the increase in fuel use in automobiles, the use of carbon-emitting chemicals in industry, and the generation of energy from traditional resources such as fossil fuel and coal (Iqbal, 2020). Such occurrences result in the emission of toxic gases contributing to environmental damage. The global community is pushing a circular economy to prevent such harmful gas emissions. A circular economy encourages the reuse or recycling of resources (Helander et al., 2019). Renewable energy is a prominent example of a circular economy. There is a significant relationship between circular economy and environmental sustainability (Oláh et al., 2020) because renewable energy is generated from resources such as water and air that can be reused multiple times and emit no greenhouse gases, thereby promoting environmental sustainability.

Organizations play a vital part in the circular economy process. According to the literature, organizational support functions as a moderator. Boudreaux et al. (2019) examined the moderating influence of organizational support on the link between social qualities and entrepreneurship in this scenario. The 10-year data collection was used as a sample for the inquiry by merging it. The selection spans the years 2002 through 2012. According to the study results, organizations' support functions as a critical moderator in the association between social qualities and entrepreneurship. Likewise, Wen et al. (2019) examined the moderating influence of organizational support on the link between emotional intelligence and emotional labor. The inquiry into the Chinese hotel business was conducted in China. The data set of 279 hotel industry employees was used as a sample. The sample was collected through the use of questionnaires. According to the investigation's findings, organizational support is a significant moderator. Thus, the hypotheses drawn from the preceding discussion are as follows.

H4: Organizational Support significantly moderates the association between Circular Economy Readiness and Environmental Sustainability.

Research Methods

This study studies the relationship between innovation adoption, circular economy readiness, and environmental sustainability in Peru, as well as the moderating effect of organizational support. Using questionnaires, the researchers collected the data. The variables are measured via items or questions. These questions or items are culled from earlier publications. The innovation adoption has six questions from Aboelmaged et al. (2019); circular economy readiness was measured with ten questions from Alvarez-Risco et al. (2021); organizational support has eight questions from Li et al. (2019); and environmental

sustainability was measured with seven questions from Danso et al. (2019).

In addition, the researchers utilized smart PLS to analyze the data. It gives the most accurate estimation results using massive data sets and intricate models (Hair Jr et al., 2020). In addition, it is a handy instrument for primary data analysis (Hair et al., 2017). Moreover, the researchers employed two independent variables, innovation adoption (IAD) and circular economy preparedness (CER). In contrast, the researchers used organizational support (ORS) as a moderating variable and environmental sustainability as a dependent variable (ENS). Figure 2 contains a listing of these variables.
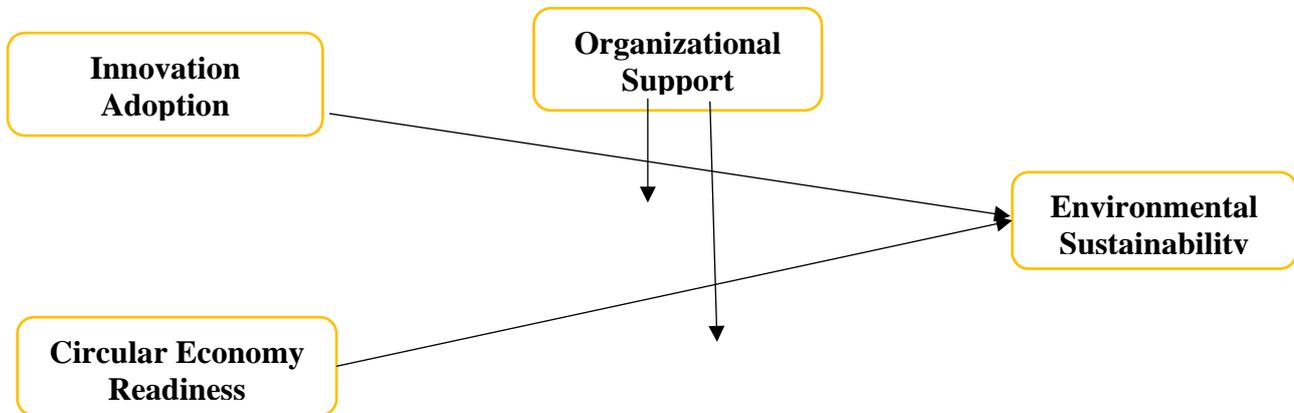

Figure 2. Theoretical Framework

Research Findings

The researchers examine the correlation between the items, and the results indicate that the average value extracted (AVE) and factor loadings are more significant than 0.50. In contrast, the results also demonstrated that the composite reliability (CR) and Alpha are more significant than 0.70. These results showed a strong link between items. Table 1 summarizes these results.

The researchers also examine the association between variables using cross-loadings and Fornell Larcker. The results demonstrated that the average figures revealing the relationships between variables are greater than those showing the relationships between other variables. These results demonstrated a low correlation between factors. These consequences are highlighted in Tables 2 and 3.

Table 1: Convergent Validity

Constructs	Items	Loadings	Alpha	CR	AVE
Circular Economy Readiness	CER1	0.857	0.948	0.955	0.682
	CER10	0.803			
	CER2	0.818			
	CER3	0.832			
	CER4	0.833			
	CER5	0.842			
	CER6	0.801			
	CER7	0.836			
	CER8	0.787			
	CER9	0.847			
Environmental Sustainability	ENS1	0.762	0.900	0.922	0.628
	ENS2	0.644			
	ENS3	0.789			
	ENS4	0.830			
	ENS5	0.832			
	ENS6	0.841			
	ENS7	0.830			
Innovation Adoption	IAD1	0.941	0.975	0.979	0.871
	IAD2	0.911			
	IAD3	0.951			
	IAD4	0.934			
	IAD5	0.906			
	IAD6	0.954			
	IAD8	0.932			
Organizational Support	ORS1	0.827	0.923	0.938	0.655
	ORS2	0.585			
	ORS3	0.860			
	ORS4	0.847			
	ORS5	0.810			
	ORS6	0.866			
	ORS7	0.861			
	ORS8	0.781			

Table 2: Fornell Larcker

	CER	ENS	IAD	ORS
CER	0.826			
ENS	0.489	0.793		
IAD	0.483	0.446	0.933	
ORS	0.448	0.424	0.425	0.809

Table 3: Cross-loadings

	CER	ENS	IAD	ORS
CER1	**0.857**	0.455	0.403	0.371
CER10	**0.803**	0.309	0.321	0.349
CER2	**0.818**	0.456	0.452	0.353
CER3	**0.832**	0.454	0.434	0.380
CER4	**0.833**	0.425	0.450	0.368
CER5	**0.842**	0.386	0.350	0.395
CER6	**0.801**	0.305	0.325	0.354
CER7	**0.836**	0.421	0.455	0.376
CER8	**0.787**	0.381	0.392	0.360
CER9	**0.847**	0.388	0.352	0.393
ENS1	0.453	**0.762**	0.431	0.367
ENS2	0.250	**0.644**	0.343	0.242
ENS3	0.423	**0.789**	0.407	0.347
ENS4	0.381	**0.830**	0.305	0.322
ENS5	0.384	**0.832**	0.326	0.360
ENS6	0.407	**0.841**	0.333	0.361
ENS7	0.374	**0.830**	0.306	0.328
IAD1	0.452	0.396	**0.941**	0.428
IAD2	0.458	0.398	**0.911**	0.396
IAD3	0.450	0.423	**0.951**	0.412
IAD4	0.445	0.438	**0.934**	0.369
IAD5	0.454	0.397	**0.906**	0.394
IAD6	0.453	0.419	**0.954**	0.415
IAD8	0.443	0.435	**0.932**	0.368
ORS1	0.336	0.333	0.346	**0.827**
ORS2	0.257	0.256	0.182	**0.585**
ORS3	0.385	0.353	0.355	**0.860**
ORS4	0.357	0.336	0.344	**0.847**
ORS5	0.388	0.304	0.378	**0.810**
ORS6	0.409	0.372	0.376	**0.866**
ORS7	0.406	0.413	0.391	**0.861**
ORS8	0.340	0.349	0.346	**0.781**

The researchers also examine the connection between factors using the Heterotrait Monotrait (HTMT) ratio. The results demonstrated that the values do not exceed 0.85. These results showed a low correlation between factors. Table 4 outlines these results.

Table 4: Heterotrait Monotrait Ratio

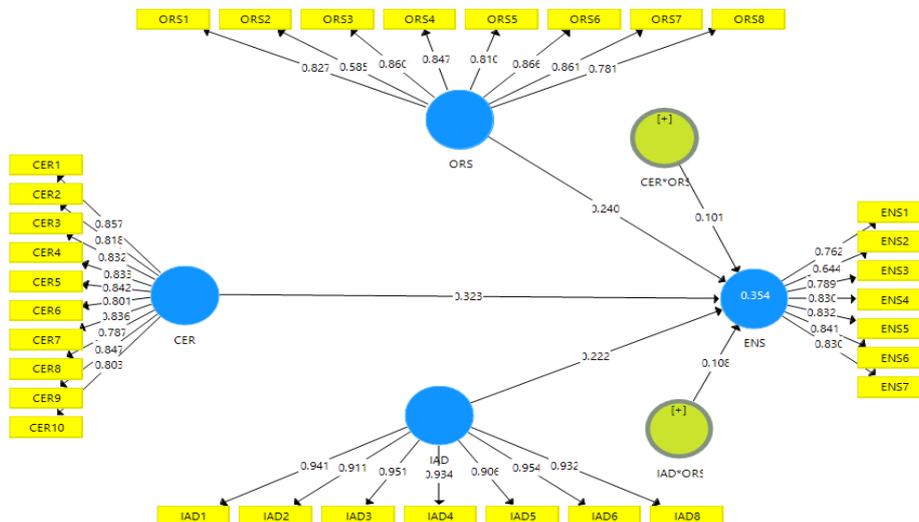|	CER	ENS	IAD	ORS
CER				
ENS	0.514			
IAD	0.495	0.472		
ORS	0.477	0.459	0.446	

Figure 3. Measurement Assessment Model

Accept H1 and H2 as innovation adoption and circular economy readiness positively correlates with environmental sustainability in Peru. In addition, the results demonstrated that organizational support moderates' innovation adoption, circular economy preparedness, and environmental sustainability in Peru and supports hypotheses H3 and H4. Table 5 outlines these results.

Table 5: A Path Analysis

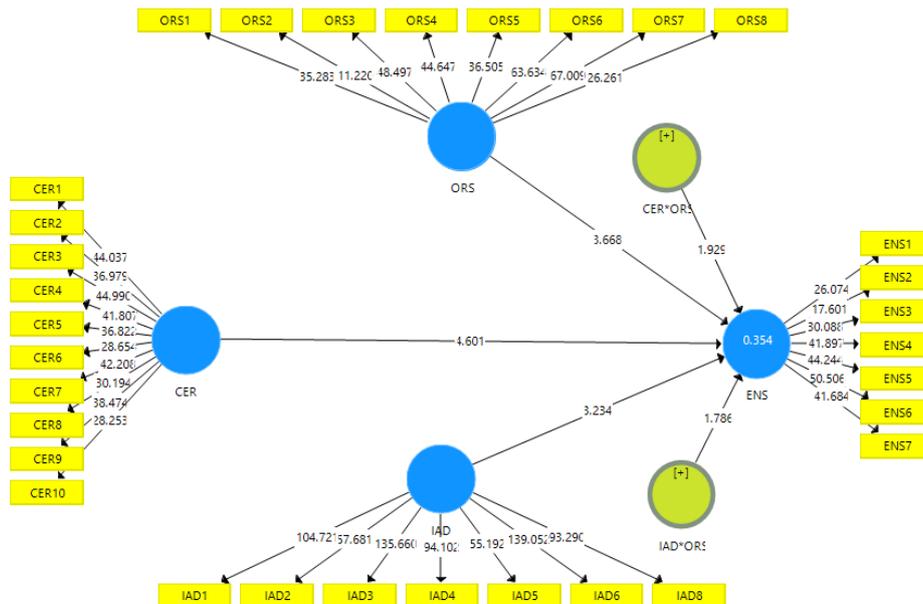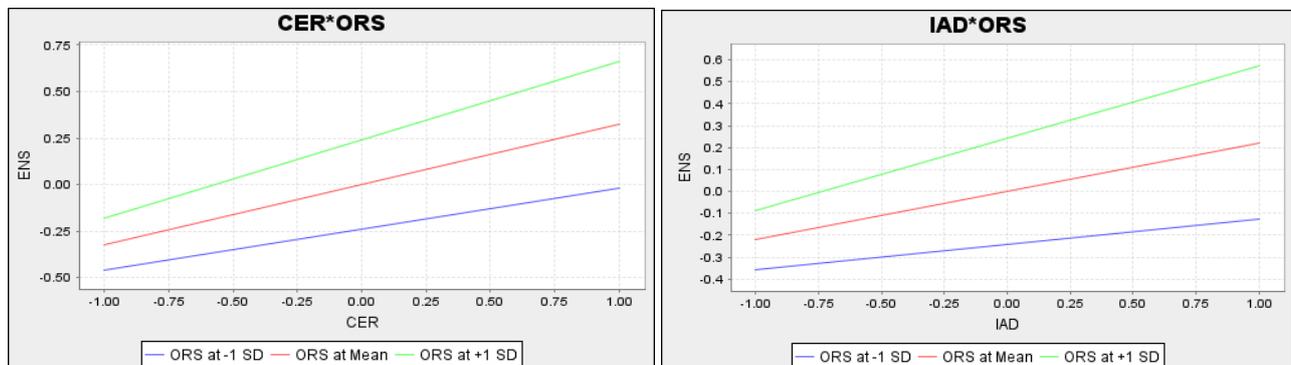| Relationships	Beta	Standard Deviation	T Statistics	P Values
CER -> ENS	0.323	0.070	4.601	0.000
CER*ORS -> ENS	0.101	0.053	1.929	0.028
IAD -> ENS	0.222	0.069	3.234	0.001
IAD*ORS -> ENS	0.108	0.060	1.786	0.039
ORS -> ENS	0.240	0.066	3.668	0.000

Figure 4. Structural Assessment Model

Figure 5. Moderation Analysis

3. DISCUSSIONS

The results demonstrated a correlation between innovation uptake and environmental sustainability. This is backed by Garavan et al. (2021)'s research on the importance of innovation adoption in environmental sustainability. The research indicates that outmoded resources, technologies, and procedures that contribute to environmental pollution can be easily eliminated from commercial organizations where administrators prioritize innovation adoption when picking resources and techniques. Consequently, businesses contribute to environmental sustainability. Following the findings of Shahzad et al. (2020), adopting innovative technical resources, energy resources, and materials enhances organizational personnel's ability to evaluate environmental conditions. It fosters the development of sustainable environmental performance. Therefore, recent research suggests a positive correlation between innovation uptake and ecological sustainability.

The results demonstrated a correlation between circular economy readiness and environmental sustainability. These findings are consistent with Sharma et al. (2020)'s study on the importance of the circular economy in environmental sustainability. The study indicated that waste emissions and pollution are reduced when

businesses can employ renewable resources in their operations and are prepared for circular economy integration. Therefore, the environment's quality is sustainable. These results concur with the research conducted by Schwarzer et al. (2021). This study hypothesizes that an economy is less likely to pollute the environment if its business organizations have the financial resources, competent human capital, and proper tactics to implement circular economy concepts. Consequently, environmental sustainability is achievable.

Results indicated that organizational support significantly moderates the relationship between innovation adoption and environmental sustainability. Cheng et al. (2021)'s investigation supports these findings. According to the previous study, organizational workers frequently identify environmental difficulties and wish to alter the currently utilized resources and processes. Innovation is only possible in some organizational domains when personnel receive organizational support. Therefore, innovation adoption has the greatest impact on environmental sustainability when organizational support is present. These findings are also consistent with the findings of Mughal et al. (2022), who assert that support from top management and business owners enables organizational staff to think creatively and put innovative ideas into practice. Additionally, supportive firms ensure that their team works in a sustainable atmosphere. Consequently, organizational support reinforces the connection between innovation uptake and environmental sustainability.

Results indicated that organizational support significantly moderates the relationship between circular economy readiness and environmental sustainability. These findings are reinforced by the research of Donati et al. (2020), which demonstrates that when employees have access to organizational assistance, they strive to accomplish their duties efficiently, regardless of their motivations. These employees are likely to assess the environmental implications of corporate activities and prepare to implement a circular economy. These organizations contribute to environmental preservation. These findings are also consistent with Kiss et al. (2019)'s research, which indicates that an organization's sense of duty towards its employees pushes its owners and top management to create a clean work environment and be prepared for the circular economy. Consequently, organizational assistance strengthens the connection between circular economy preparedness and environmental sustainability.

4. IMPLICATIONS

Because of the study's contribution to literature, authors can gain insight. This study simultaneously explores the effects of innovation uptake and circular economy preparedness on environmental sustainability. One of the study's contributions is investigating the moderating effect of organizational support on the relationship between innovation adoption, circular economy readiness, and environmental sustainability. This is a preliminary examination of the influence of innovation adoption and circular economy preparation on Peru's environmental sustainability.

This article has significant empirical consequences for business organizations in Peru and other countries with comparable business environments. The report provides corporate management with advice on contributing to environmental sustainability. The research suggests that organizational management should be inclined toward innovation adoption so that company pollution emissions can be decreased and a contribution can be made to environmental sustainability. It also indicates that corporate management must ensure readiness for the circular economy because the circular economy would help businesses achieve environmental sustainability. The research aids policymakers in formulating environmental sustainability strategies based on innovation uptake and circular economy preparedness. To ensure environmental sustainability and environmental sustainability, the current article further stipulates that organizational representatives must demonstrate support for subordinates. In addition, the study suggests that firms must have a supportive attitude toward their employees to prepare for a circular economy and environmental sustainability.

5. CONCLUSION

The purpose of the study was to investigate the relationship between innovation adoption, circular economy readiness, environmental sustainability, and the function of organizational support. Peruvian data on organizational support, innovation adoption, preparation for the circular economy, and environmental sustainability were gathered via questionnaires. The results demonstrated a correlation between innovation uptake and readiness for the circular economy and environmental sustainability. The study suggests that when companies implement novel materials, physical resources, and procedures, they can enhance environmental performance and maintain environmental quality. The results also revealed that companies prepared for the circular economy might safeguard the environment and ensure environmental sustainability. The results also demonstrated that organizational support is an essential moderator between innovation adoption, preparation for the circular economy, and environmental sustainability. If employees have access to organizational assistance, the organization is more likely to embrace innovation, be prepared for the circular economy, and achieve environmental sustainability.

6. LIMITATIONS

The study has only shed light on two variables for assuring individual businesses' environmental sustainability: innovation adoption and circular economy readiness. Other aspects, such as corporate social responsibility, green human resource management, and green supply chain, can aid in decreasing environmental pollution and supporting the ecosystem. Therefore, future researchers investigating environmental sustainability should take these aspects into account. In addition, a single mediator, such as organizational support, has been investigated

between innovation adoption, circular economy readiness, and environmental sustainability. Future academics must feel obligated to examine at least one mediator between innovation uptake, preparation for the circular economy, and environmental sustainability.

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