Energy Crisis and Security Challenges in the World:
Sustainable Responses of the Asian Economies and Societies

OBIC Book Series – Volume 3.

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Sustainable Responses of the Asian Economies and Societies

Selected studies presented at the
6th Annual OBIC Conference
(Budapest, May 5, 2023)

Oriental Business
and Innovation Center
Budapest Business School

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Foreword

In our days—just shortly after the Coronavirus 19 pandemic hit the world's society and economy hard—mankind faces new trends and challenges. These phenomena are multifaced but can be characterized by the trend of challenging the so-called Pax Americana, especially by the emerging political and economic powers claiming the necessity of new, multipolar world order based on the increasing respect of national sovereignty, however, exact goals and the way of implementation of such new order cannot be seen clearly, only several "accompanying" phenomena.

One of these phenomena—the energy crisis—can be pointed out the start of which was an economic impact of Covid 19 pandemic, but its intensity—with massive political interpretation—was boosted by the Russo-Ukrainian war and the economic and political sanctions being imposed on Russia by the European Union and other countries. No need to say, the so-called "Special Military Operation" as Russian political and media sources officially call the Russo-Ukrainian war, brought about fears and concerns about its possible escalation even to a new world war. Such a situation has never been experiences since the early 1990's when bipolar world ended. In addition, tensions in other sensitive regions of the world—especially, in East Asia—also increased, like in the Taiwan Strait, which is one of the most prominent locations of the rivalry between China and the United States, but the continued missile tests of North Korea can also be mentioned.

These complex phenomena were set to the forefront of the recent Annual International Scientific Conference of the Oriental Business and Innovation Center (held in Budapest, on 5th May 2023). In the present issue (No. 3) of OBIC Book Series, we present a selection of studies which were presented at the mentioned conference under title "Energy Crisis and Security Challenges in The World: Sustainable Responses of The Asian Economies and Societies".

Our authors pursued their research not only by focusing on political matters but also extended their research to the connected fields of economy, business,

administration, regional and social sciences as well. Therefore, a kind of multidisciplinary approach, in which all these studies were developed.

It can be seen that digitalization is also another important and general phenomenon in the modernizing economies and societies. The first study, *Evaluation of Digital Economy Development in 31 Chinese Provinces and Cities* by Cai Jing (et al.) focuses on this characteristic phenomenon and gives a thorough analysis on this trend in China.

As for China's global endeavors, the Belt and Road Initiative (BRI) can be pointed out as the most prominent initiative in our days. Perhaps it is well-known for the esteemed Readers that China intends to build up a thorough land and marine logistical network to be closely connected to Europe, so the BRI projects in Asia, Africa, and Europe are known. But it is perhaps a brand-new aspect that BRI is also intended to be involve Latin America as well. This new aspect Lady Gaviria-Ochoa (et al.) elaborated in her study *BRI and Latin America: Analysis of Political, Economic, and Cultural Development in the Period 2013–2022*.

Even since the first oil-crisis (1973) countries without rich oil reserves strive need to adopt the soaring energy prices by more economic and environmentally-sound solutions, and in this respect many countries try to rely on the achievements and good practices of other regions or nations. Such is the case of Vietnam, which is analyzed in the study of Nguyen Thi Kim Cuc *Vietnam's Response to a Call for a Renewable Energy Revolution in the Context of Trade Integration: What Could be Learnt from the EU?*

In their study *Chinese Pursuit of Energy Security via Partnerships' Development within the SCO Mechanism* the authors, Slobodan Popovic and Ljiljana Stevic examined that SCO (Shanghai Cooperation Organization) and its Energy Club operate as a multilateral mechanism when it comes to energy cooperation or if bilateral arrangements are needed for China to secure its energy needs. Besides the analysis the authors outlined recommendations for a better understanding of energy security issues within the scope of Chinese instigated mechanisms of cooperation and diversification of sources and cooperation that brings new geo-political and geo-economic "question marks".

Murat Unanoğlu (et al.) in his study also focused on the phenomenon of digitalization in a special context: *The Comparison of Digitalization Based on Innovation or Economic Development Through Bibliometric Analysis Between Asian Countries*

and European Countries. The claim that bibliometric analysis provides a valuable tool for comparing the progress made by different regions and illustrates the significance of these areas in the past, present, and future.

With her study, Reema Zia added another important interpretation of security challenges, as in her study *Comparative Advantage and Policy Analysis of Pakistan's Rice (Paddy) Sector* the importance of the food security is pointed out. The study focusing on Pakistan, especially the Punjab area, underlining that public and private sectors should work together to minimize the major costs, especially the costs of fertilizers and pesticides.

I am confident that these studies will not only be interesting, but also give ideas for professionals and scholars for future research or practical implementation.

I wish to express my gratitude for the financial and moral support received from Budapest Business School, University of Applied Sciences (BBS) and from Magyar Nemzeti Bank (Central Bank of Hungary) without which neither the mentioned conference could take place, nor the present book of studies could be published.

Budapest, July 2023

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Evaluation of Digital Economy Development in 31 Chinese Provinces and Cities

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Abstract: The development of the digital economy is a strategic choice to build a new pattern of China's economic development and a necessary path to promote the high-quality development of China's economy. In addition, the digital economy has become a new driving force for China's economic growth and quality improvement. This paper constructs a comprehensive evaluation system for the digital economy (20 indicators in total) in four dimensions: digital infrastructure, digital industry revenue generation, digital service capacity, and digital innovation capacity. Based on regional sample data from 31 provinces and cities in China from 2014 to 2021, this paper uses an Entropy-based TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) method to examine and assess the overall level of China's digital economy development, such as a weak industrial transformation, weak innovation capacity, lagging digital governance, an unbalanced internal structure of the digital economy, and unbalanced development within regions. The authors then make targeted recommendations based on specific issues. On the supply side, it is necessary to support infrastructure development, nurture market players, enhance innovation capabilities and strengthen the talent pool to form a strong support for the development of the digital economy. Meanwhile, on the demand side, a wide range of application scenarios and market areas should be built for the digital transformation of enterprises, residents, and government departments to form an effective driver for the development of the digital economy.

Keywords: Digital Economy, Chinese Digital Economy Development, Entropy-based TOPSIS Method, Digital Industrialization, Digital Governance
JEL: 011, 014, G18, R11, R50

1. Introduction

With the development of information technology, the digital economy has become a new engine to drive China's economic growth. The digital economy is based on digital technology, using new technologies such as the Internet, big data, artificial intelligence, and blockchain to upgrade and transform traditional industries, thus promoting rapid economic development. The development of the digital economy in China is at a stage of rapid growth and has become an important force in driving economic development.

Firstly, the development of the digital economy in China is characterized by rapid growth. With the popularity of the Internet and the spread of mobile devices, China's digital economy is showing explosive growth. By 2021, China's digital economy already accounted for over 36 percent of gross domestic product (GDP), the number of start-ups in the digital economy continues to grow, and the demand for digital transformation is increasing. China's digital economy has become a new engine for the country's economic development and provides a new impetus for the development of the global digital economy. Secondly, the development trend of China's digital economy is characterized by the following aspects: firstly, the continuous upgrading of digital technologies, including the widespread use of cloud computing, the Internet of Things, 5G, artificial intelligence, and other technologies, which provide strong support for the development of the digital economy; secondly, the diversified development of the digital economy, extending from traditional sectors such as e-commerce, finance and education to the new digital culture, digital healthcare, digital agriculture. Thirdly, the deep integration of the digital economy with the real economy has promoted the transformation and upgrading of traditional industries.

The promotion of the digital economy to China's economic development is mainly reflected in the following aspects. Firstly, it promotes innovation and entrepreneurship, stimulating enterprises' innovative vitality and competitiveness. Secondly, it enhances the competitiveness and creativity of the economy and promotes the rapid development of China's economy. Besides this, it also enables the upgrading of employment and consumption and drives up the living standard of the people. However, the development of the digital economy is also facing several challenges and problems. Firstly, there are still specific bottlenecks and difficulties in the integration of the digital economy with traditional industries, which require continuous promotion of innovation and upgrading; secondly, the security of the digital economy needs to be given high priority and strengthened

management; thirdly, the issues of equity and sustainability of the development of the digital economy also need to be given attention.

This paper adopts the entropy power TOPSIS research method to study the development status of China's digital economy from 2014 to the present and the development trend. In addition, the authors have used the literature review method to interpret the definition and characteristics of the digital economy in this paper. The authors also analyze the current situation and development trend of China's digital economy and discuss the promotion of the digital economy to China's economy and will also discuss the challenges and problems faced by the digital economy and propose corresponding solutions and suggestions, hoping to contribute to global digital economy governance and cooperation.

2. Literature Review

The digital economy is an economic form that uses digital technology to change economic and business models and create new economic growth points. With the continuous development of digital technology, the digital economy has become a significant trend in today's economic development (Lestantri et al., 2022). Governments and enterprises are using it as an essential tool to promote economic growth. This article will review the digital economy's definition, development history, impact, and future development trends (Carlsson, 2004).

Definition of the digital economy

The digital economy refers to using digital technology to promote economic development and economic activities supported by digital technology. The digital economy covers many areas, including the digital industry, manufacturing, business, trade, finance, and so on. A digital economy is a new form characterized by digitalization, networking, platform station, intelligence, innovation, etc. (Bukht and Heeks, 2017).

The development history of the digital economy

There are three stages for the development of the digital economy. The first stage is the information technology era. This stage is mainly based on information technology, represented by computers, and the traditional economy and business model are changed through information technology (Earl, 2000). The second

stage is the Internet era, dominated by Internet technology, represented by e-commerce and online marketing, and the use of the Internet to change the economy and business models (Lee et al., 2018). The third stage is the digital economy era. This stage is dominated by digital technologies such as artificial intelligence, big data, the Internet of Things, and cloud computing, which change the economy and business models through the use of digital technologies (Li et al., 2022; Li et al., 2019; Ulas, 2019).

Impact of the digital economy

The development of the digital economy has had an essential impact on the economy and society. The digital economy has provided new growth points for economic development. The digital economy has promoted the development of digital industries, which creates many jobs and injects fresh momentum into economic development (Sturgeon, 2021). The digital economy has changed the traditional economic and business model and promoted the transformation and upgrading of the economy and industry (Chauhan et al., 2022). The digital economy is changing how people produce and consume, promoting the coordinated development of productivity and production relations. The digital economy promotes the inclusive and sustainable development of society. The digital economy provides more convenient and efficient services for society while promoting sustainable development and future economic and social development opportunities (Viriyasitavat et al., 2019).

The development of the digital economy can make an essential contribution to a country's sustainable development. The digital economy is an information and communication technology-based economic activity that is efficient, innovative, and flexible and can contribute to economic growth, productivity, labor efficiency, a green economy, and sustainable social development (Rosário and Dias, 2022). Firstly, the digital economy can drive economic growth and increase productivity. The digital economy promotes the application of information and communication technologies to improve the productivity and competitiveness of enterprises and encourage economic growth. The digital economy can also promote industrial upgrading and transformation, drive the development of new economies and business models, and inject new momentum into economic development (Zhang et al., 2021). Secondly, the digital economy can promote a green economy and sustainable development. With its low-carbon, energy-saving and intelligent features, the digital economy can encourage the effective use of resources and environmental protection (Li et al., 2022). For example, digital production and service models

can reduce the waste of energy and materials, digital transport and logistics systems can reduce air pollution and traffic congestion, and digital energy systems can promote renewable energy, etc. The digital economy can also promote social equity and sustainable development, improve resource efficiency and environmental benefits, and create more opportunities and possibilities for sustainable development in the future (Zhang et al., 2022). Finally, the development of the digital economy also needs to focus on sustainable development. The development of the digital economy also faces a series of sustainability challenges, such as energy consumption and e-waste. The digital economy needs to strengthen environmental protection and resource management, promote the digital economy's green development, and reduce the digital economy's negative impact on the environment (Luo et al., 2022). The digital economy also needs to pay attention to social equity and sustainable development, promote the sound development of the digital economy and create more opportunities and conditions for sustainable economic and social development (Wang and Zhong, 2023).

The digital economy can therefore make an essential contribution to the sustainable development of a country. The growth of the digital economy needs to strengthen sustainability management, promote the sustainable development of the digital economy and achieve a win-win situation for both the digital economy and the economy and society (Guo et al., 2022). In addition, existing economic geography theories provide valuable insights into the spatial dynamics of digital economy adoption and its impact on regional development. Some scholars demonstrate that digital economy development significantly contributes to firm physical innovation and catalyzes strong substantive innovation more than strategic innovation (Feng and Nie, 2022). In addition, the urban development literature illuminates the role of the digital economy in shaping urban growth and sustainability. Several Chinese scholars have explored the urban planning and governance strategies needed to leverage digital technologies for smart city development (Li et al., 2011). By combining insights from this literature, our study aims to analyze the level of digital economy development in Chinese regions considered along four dimensions: digital infrastructure, digital industry revenue generation, digital service capacity, and digital innovation capacity, while considering the broader urban development context and the potential for creating sustainable and inclusive cities.

Furthermore, case studies related to cities where the digital economy has contributed to development can also illustrate the need for governments to focus on developing the digital economy. For example, the case of the city of Shanghai

highlights how strategic investment in digital infrastructure and cultivating a vibrant innovation ecosystem can facilitate its transformation into a thriving digital hub (Gu et al., 2022). What is more, in the case of Helsinki, through modern digital technologies, cities aim to optimize their performance and services. In addition, cities actively support modern digital technologies to facilitate digitization and the emergence of a data-based innovation and knowledge economy (Hämäläinen, 2020). This informs policy recommendations for other cities in China and can also provide lessons for development in other regions.

3. Methodology

3.1. Research Questions and Methods

The research questions of this paper are as follows.
1. How did China's digital economy develop from 2014 to 2021?
2. Are there any geographical differences in the development of the digital economy?
3. What was the focus of China's digital economy development during this period? and what is the future trend?

This paper uses the Entropy-based TOPSIS method to analyze 20 indicators to explore the development of China's digital economy from 2014 to 2021. The entropy-weighted based TOPSIS method is a multi-attribute decision analysis method, which combines the entropy-weighted method and TOPSIS method and can consider the correlation and importance of each indicator comprehensively and has strong applicability to multi-attribute decision problems.

3.2. Data Source

The accuracy of the evaluation of the development level of the digital economy depends on the understanding of the connotation of the digital economy. Based on existing research results, this paper considers that the digital economy is new and based on the traditional economic system. This new economic structure is rooted in the real economy. It has the characteristics of upgrading output models and promoting industrial innovation through advanced information technology such as the Internet and artificial intelligence.

Table 1. Digital Economy Evaluation Index System

Code	*Secondary indicators*	*Primary indicators*
X1	Length of optical fiber cables (km)	Digital infrastructure
X2	Number of broadband internet access ports	
X3	Penetration rate of mobile phones (number of users per hundred people)	
X4	Number of domain names (in ten thousands)	
X5	Capacity of mobile telephone exchanges (in ten thousands)	
X6	Revenue from software business (10,000 RMB)	Revenue from the digital industry
X7	Revenue from information technology services (10,000 RMB)	
X8	Telecom business volume (100 million RMB)	
X9	E-commerce procurement volume (100 million RMB)	
X10	E-commerce sales volume (100 million RMB)	
X11	The breadth of digital financial coverage	Digital service capability
X12	The depth of digital financial usage	
X13	Level of online and mobile payments	
X14	Level of digitalization of inclusive finance	
X15	Number of employed persons in urban units engaged in information transmission, software, and information technology services (in ten thousands)	
X16	Full-time equivalent (FTE) R&D personnel in industrial enterprises above designated size (person-years)	Digital innovation capability
X17	R&D expenses in industrial enterprises above designated size (10,000 RMB)	
X18	Number of R&D projects in industrial enterprises above designated size	
X19	Technology market turnover (100 million RMB)	
X20	Number of domestic patent applications and authorizations	

Source: Initial data were collected by authors from official websites of the National Bureau of Statistics of China (https://data.stats.gov.cn/english/).

From an economic point of view, the digital economy can meet the demand for digital consumption through digital products and services. In addition, the digital economy should be an ecosystem in which digital service producers, digital application consumers, digital output innovators, and the digital technology environment coexist harmoniously. Based on this and considering the principles of data availability, continuity, and operationalization, the authors cover the digital features of economic development as far as possible. Hence, this paper constructs a digital economy evaluation index system comprising 4 primary and 20 secondary indicators, including digital infrastructure, digital industry income generation,

digital service capacity, and digital innovation capacity, as shown in Table 1. All initial data was collected by authors from official websites of the National Bureau of Statistics of China (https://data.stats.gov.cn/english/). The four indicators—breadth of digital financial coverage, depth of digital financial usage, level of digitalization of inclusive finance and level of online mobile payments—are taken from the Peking University Digital Inclusive Finance Index, which was compiled by a joint research group formed by the Peking University Digital Finance Research Centre and Ant Financial Services Group (Guo et al., 2020).

3.3. Calculation Process

The main idea is to determine the weight of each indicator by the entropy method and then use the TOPSIS method to make a comprehensive evaluation. This method uses the objective weighting idea of the entropy method and the TOPSIS method to approximate the ideal solution, which can effectively eliminate the influence of human subjective factors. It is more effective than both the entropy method and the TOPSIS method. The primary process of the model shows below.

1. Building the original matrix. First, the data on the development of the digital economy in Chongqing is collated. Let a total of n years, and m indicators be selected for each year to build the original matrix.

$$X=\left(x_{ij}\right)nm(\,i=1,2,3,\ldots,n;\,j=1,2,3,\ldots,m) \tag{1}$$

2. The selected indicators were normalized to initially eliminate differences caused by the dimensions of the variables. As all the data and information selected in this study are positively oriented indicators, there is no need for either positive or reverse transformation. Therefore, this study adopts the "normalization by mean" method for data processing.

$$Y_{ij}=X/\,Mean \tag{2}$$

3. Determine the weights for the values of the j_{th} indicator of the i_{rh} object:

$$P_{ij}=\frac{x_{ij}}{\sum_{i=1}^{n}x_{ij}} \tag{3}$$

4. Determine the entropy value of the j_{th} indicator:

$$e_j = -\frac{1}{\ln(n)} * \sum_{i=1}^{n} P_{ij} \ln(P_{ij}) \ , \ (i = 1, \ldots, n; j = 1, \ldots, m) \tag{4}$$

5. Then, calculating the information utility value d:

$$d_j = 1 - e_j \tag{5}$$

6. Determine the entropy weight of the j_{th} indicator:

$$w_j = \frac{(1 - e_j)}{\sum_{j=1}^{m} (1 - e_j)} \ , \ 0 \le w_j \le 1, \sum_{i=1}^{m} w_j = 1 \tag{6}$$

7. Compute scores for individual indicators and overall performance level.

$$S_{ij} = w_i \times x_{ij}, \ S_i = \sum\nolimits_{j}^{n} S_{ij} \tag{7}$$

8. After the above steps, then use TOPSIS method for evaluation. Assuming there are m_{th} object, n_{th} indicators, then the matrix is $X = (x_{ij})_{mn}$, Normalize the decision matrix $Y = (y_{ij})_{mn}$. (8)

9. Next, to compute the weighted and normalized decision matrix *V*:

$$V = (v_{ij})_{m \times n} = (w_j y_{ij})_{m \times n} \tag{9}$$

10. Using the weighted and normalized decision matrix *V*, calculate the positive ideal solution and negative ideal solution. In the TOPSIS method, monotonicity is usually required. The formulas for positive and negative ideal solutions are as follows:

$$\text{positive ideal solution: } X^+ = (v_1^+, v_2^+, \ldots, v_n^+), \ v_j^+ = max_{1 \le i \le m} v_{ij} \tag{10}$$
$$\text{negative ideal solution: } X^- = (v_1^-, v_2^-, \ldots, v_n^-), \ v_j^- = min_{1 \le i \le m} v_{ij} \tag{11}$$

11. To calculate the distances between each object and its positive and negative ideal solutions, usually use the Euclidean distance:

$$S_i^+ = \sqrt{\sum\nolimits_{j=1}^{n} (v_{ij} - v_j^+)^2} \ , \ i = 1, 2, \ldots, m$$
$$S_i^- = \sqrt{\sum\nolimits_{j=1}^{n} (v_{ij} - v_j^-)^2} \ , \ i = 1, 2, \ldots, m \tag{12}$$

12. Computing the relative closeness of each object:

$$C_i^+ = S_i^- / \left(S_i^+ + S_i^- \right) \tag{13}$$

13. The relative closeness measure C_i^+ of each object is its comprehensive score index, with a higher C_i^+ indicating a better object.

4. Results

4.1. Empirical Analysis

Based on constructing the evaluation index system and measurement model for the development level of digital economy in China, the weight (w_j) of each evaluation index in each province and city is derived according to the above formula, as shown in Table 2 below.

Table 2. The weights of each evaluation index in 31 provinces and cities in China from 2014 to 2021.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20
Shanghai	1.84	1.92	0.84	5.24	2.29	6.15	10.18	24.48	8.15	4.68	2.36	4	1.45	2.44	3.91	0.2	1.18	0.93	13.71	4.05
Beijing	2.46	1.65	0.04	3.19	4.65	13.1	16.32	24.77	3.59	8.92	1.99	3.94	1.67	2	1.4	0.55	0.49	0.4	3.93	4.95
Zhejiang	2.21	1.94	0.08	4.62	0.76	4.73	6.18	21.98	5.1	4.96	1.7	2.06	0.93	1.41	1.89	1.31	1.96	4.29	28.57	3.33
Jiangsu	2.15	2.5	0.35	3.61	6.11	1.71	5.44	28.97	2.5	6.22	2.78	3.04	1.53	1.43	0.34	0.7	2.29	4.01	16.06	8.27
Fujian	3.35	2.18	0.05	13.8	0.22	1.8	1.94	23.97	6.95	6.56	2.07	3.99	1.61	1.11	0.98	1.9	3.87	5.75	13.59	4.29
Guangdong	3.14	2.99	0.12	0.81	0.06	3.35	7.25	21.58	3.79	4.58	1.77	3.37	1.86	1.1	3.29	1.89	2.15	8	19.38	9.49
Tianjin	5.89	7.37	0.84	2.59	0.9	6.89	11.75	33.96	2.05	4.3	2.61	3.73	1.58	1.13	0.16	3.06	1.81	0.55	7.53	1.3
Hubei	4.25	3.07	0.42	8.49	0.02	3.54	7.9	25.82	6.34	4.52	2.5	3.2	1.61	0.89	1.47	1.26	1.89	4.47	5.95	12.39
Anhui	2.15	1.88	0.08	4.48	0.74	4.59	6	21.35	4.95	4.81	2.74	2.61	1.6	0.63	1.83	1.46	3.32	3.78	27.75	3.23
Shandong	3.56	2.87	0.22	2.71	0.17	3.05	3.13	25.55	4.31	5.61	2.59	3.13	1.78	0.88	0.2	1.02	0.4	4.83	23.39	10.56
Chongqing	3.6	3.32	0.55	6.09	0.62	6.32	5.27	29.12	9.27	4.8	2.29	3.26	1.16	0.74	0.35	1.88	3.28	5.3	8.9	3.92
hainan	2.45	3.88	0.11	5.08	0.7	11.54	13.2	15.99	0.59	2.97	1.5	1.74	0.78	0.55	1.01	1.4	0.81	1.67	20.15	13.88
Shaanxi	4.88	2.74	0.37	9.5	0	6.66	8.91	26.3	6.73	7	2.23	3.63	2.41	0.66	0.46	0.25	1.9	2.6	7.28	5.48
Henan	1.32	2.41	0.37	8.3	0.43	1.34	1.76	25.6	3.34	1.01	2.63	3.48	1.95	0.69	1.78	0.24	2.62	4.4	28.04	8.3
Jiangxi	6.31	1.74	0.66	11.6	1.46	4.12	1.5	19.03	5.45	2.84	2.1	1.95	1.02	0.38	0.27	5.65	3.57	9.93	12.4	8.05
Sichuan	3.9	3.74	0.58	4.17	0.04	2.83	3.19	24.75	11.87	8.22	2.11	2.71	1.18	0.88	0.64	1.09	2.9	6.52	14.49	4.2
Hunan	2.39	1.62	0.64	7.16	0.72	5.44	10.34	19.9	6.5	2.7	1.86	2.14	0.94	0.64	0.22	1.03	2.25	8.26	20.22	5.02
Liaoning	4.95	0.96	0.18	5.73	3.58	3.16	6.19	27.53	9.26	5.52	2.38	3.34	1.54	0.89	0.07	0.56	0.98	4.05	7.63	11.51
Shanxi	1.76	2.01	0.31	13.4	0.95	6.24	10.9	20.25	6.32	11.43	1.95	2.68	1.77	0.43	0.06	0.29	1.25	3.24	6.66	8.03
Guangxi	3.67	1.83	0.36	3.67	2.24	11.84	12.79	13.1	2.43	3.04	1.08	1.37	0.69	0.3	0.31	0.46	0.54	2.52	33.8	3.95
Hebei	3.5	1.62	0.43	3.88	0.42	3.84	4.62	22.43	4.3	3.73	2.1	3.01	1.83	0.65	0.69	0.13	2.04	3.51	27.28	9.99
Yunnan	6.94	3.44	0.46	15.3	0.69	3.48	4.33	26.57	6.05	2.73	2.45	2.64	1.18	0.62	0.04	2.47	5.09	4.3	2.79	8.39
Xizang	0.97	0.74	0.02	1	0.12			18.15	14.96	2.71	0.6	0.35	0.11	0.12	5.15	1.13	13.93	5.13	27.53	7.27
Ningxia	3.81	4.55	0.23	4.96	0.41	6.42	8.59	22.83	3.99	3.15	1.82	2.69	1.6	0.79	0.02	1.65	3.69	2	14.05	12.76
Neimenggu	3.2	0.85	0.15	3.15	0.01	25.32	35.28	11.01	4.61	3.18	0.87	1.41	0.65	0.2	0.01	1.14	0.24	0.72	2.66	5.35
Xinjiang	5.04	3.98	0.47	3.77	0.09	1.41	1.41	34.82	5.82	3.96	2.95	2.79	1.21	0.79	0.95	1.7	0.69	1.82	19.17	7.16
Jilin	6.06	2.38	0.43	12.7	0.81	1.33	0.67	26.11	0.77	0.12	2.26	3.09	1.64	0.83	0.86	3.75	0.7	0.55	25.72	9.22
Guizhou	2.15	2.76	0.34	21.4	0.48	5.5	8.74	21.31	1.37	1.03	1.99	2	0.91	0.31	0.36	1.09	2.87	4.52	15.27	5.6
Heilongjiang	5.17	2.12	0.55	9.32	0.3	11.29	13.07	20.62	7.67	5.11	2.29	2.65	1.36	0.6	0.53	6.07	0.68	1.02	5.91	3.67
Gansu	3.4	4.47	0.62	15.5	3.3	2.62	2.14	32.19	3.55	3.77	3.13	4.33	2.36	0.67	0.66	1.78	0.45	0.95	3.27	10.9
Qinghai	3.29	2.55	0.24	2.9	0.64	7.57	12.2	18.91	7.46	11.28	1.79	2.13	1.16	0.65	0.03	1.11	1.31	3.26	10.8	10.72

Source: Initial data were collected by authors from official websites of the National Bureau of Statistics of China (https://data.stats.gov.cn/english/).

To ease the discussion, the paper adopts the conventional geographical division method to divide the 31 provinces and cities into seven regions. It averages the digital economy development indices of the provinces and cities within the

regions to facilitate the examination of regional digital economy development trends. The results are shown in Table 3.

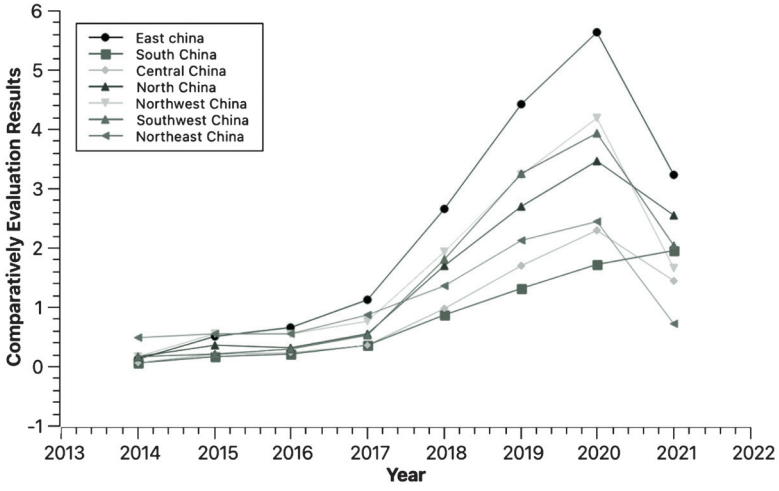
Table 3. Comprehensive evaluation of 31 Chinese provinces and cities from 2014 to 2021.

Region \ *Time*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*
East China	*0.14*	0.52	0.66	1.13	2.67	4.43	5.64	3.24
South China	*0.05*	0.16	0.22	0.37	0.87	1.31	1.72	1.96
Central China	*0.06*	0.21	0.23	0.36	0.98	1.71	2.29	1.45
North China	*0.17*	0.36	0.31	0.56	1.71	2.70	3.46	2.55
Northwest China	*0.17*	0.55	0.55	0.76	1.94	3.23	4.20	1.66
Southwest Region	*0.16*	0.22	0.30	0.53	1.81	3.26	3.93	2.03
Northeast Region	*0.50*	0.55	0.55	0.88	1.36	2.13	2.44	0.72

Source: Initial data were collected by authors from official websites of the National Bureau of Statistics of China (https://data.stats.gov.cn/english/).

In order to visualize the changes in the development of seven Chinese regions' digital economy between 2014 and 2021, the authors made a visual chart based on the above data, as shown in Figure 1 below.

Figure 1. Comprehensive Evaluation Results of Digital Economy Development in China from 2014 to 2021



Source: compiled by the authors.

At the national level, China's digital economy showed a year-on-year increase over the study period, with a 242 percent increase in 2020 compared to 2013, indicating that China's digital economy was at a rapid stage of development.

At the regional level, the seven regions also showed a significant growth trend. Still, there was an imbalance in the level of digital economy development among the regions, with East China having the highest level of digital economy. This is because Jiangsu, Zhejiang and Shanghai were ahead of the rest of the country in terms of infrastructure development, digital industrialization, and digitization of industries, reflecting their strong digital economy. Northern China was in the second echelon, with Beijing's digital economy being more developed after Guangdong and Jiangsu. It can give full play to its advantages in digital talent, IT industry and the digital transformation of mature industries. The digital economy in Tianjin, Hebei and Shanxi will be accelerated. From 2014 to 2017, the digital economy in the north-west, south-west and north-east regions lagged and grew slowly; after 2017, it grew faster. However, overall, China's digital economy development shows a large variation between regions, with a decreasing trend from the southeast to the northwest. It is also worth noting that the overall level of development has declined since 2020, due to the impact of the COVID-19 epidemic.

4.2. Policy Recommendations

Firstly, the government should increase its efforts to build digital economy infrastructure in the central and western regions and focus on rational planning of new digital infrastructure to give full play to the cluster synergy effect. Through financial transfers and other initiatives, the government should direct technology, capital, and talent toward less developed regions in the digital economy and vigorously promote the integration of advanced technologies, such as big data and the Internet of Things, with traditional industries to take advantage of the "latecomer advantage" and narrow the differences between regions. Secondly, the government should organize the removal of unfavorable factors, such as administrative regulations and policy rules that hinder the flow of factors across regions, and promote the in-depth development of digital infrastructure construction, digital economy resource sharing, and integrated development mechanisms in neighboring regions, to innovate a regional linkage model for digital economy development, and to give full play to the leading and driving role of developed digital economy regions in the neighboring regions, the "siphon effect" of resources and the harm of homogenous competition can be reduced. Finally, given the positive

impact of economic development, industrial structure, trade openness, foreign investment, and residents' purchasing power on the digital economy's development, the government should develop differentiated development strategies according to local conditions.

The southeastern coastal regions should strengthen the digital transformation of their industries and upgrade the quality of their industrial structure through the integration of digital technology with smart manufacturing, new energy, biomedicine, and software services while maintaining their openness to the outside world and their advantages in attracting foreign investment; the central and western inland regions should continue to improve their economic development and strengthen the construction of digital infrastructure to provide favorable conditions for the development of the digital economy. The government should focus on improving the investment environment to attract high-quality capital, and advanced technology, talent, and management experience are conducive to upgrading the industrial structure, which has a two-way effect on the development of the digital economy.

5. Conclusion

In conclusion, the development of the digital economy is essential for China to build a new economic pattern and achieve high-quality economic growth. This paper presents a comprehensive evaluation system for the digital economy and uses an Entropy-based TOPSIS method to examine and assess China's digital economy development. The results indicate that China's digital economy is rapidly developing but faces challenges, such as a weak industrial transformation, weak innovation capacity, lagging digital governance, and an unbalanced internal structure and regional development. To address these challenges, the government should take targeted measures on both the supply and demand sides, including supporting infrastructure development, nurturing market players, enhancing innovation capabilities, building application scenarios, and market areas for digital transformation.

The study also reveals an imbalance in the level of digital economy development among the regions, with East China having the highest level, followed by Northern China. In contrast, the northwest, southwest, and northeast regions show slow growth in the early years but have caught up in recent years. However, the overall level of development has declined since 2020 due to the impact of the

COVID-19 epidemic. To narrow the regional differences, the government should increase its efforts to build a digital economy infrastructure, promote resource sharing and integrated development mechanisms, and develop differentiated strategies according to local conditions. By doing so, China can fully tap into the potential of the digital economy and achieve sustainable and inclusive economic growth.

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BRI and Latin America: Analysis of Political, Economic, and Cultural Development in the period 2013–2022

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Abstract: In 2018, Latin America and the Caribbean (LAC) officially started to be part of the Belt and Road Initiative (BRI). This may not only influence the countries that are economically part of the project but also the political and cultural areas, due to the exchanges that are meant to achieve the initiative's goals. BRI also connects to current and potential trade and the way such relations could contribute to the incorporation of LAC into the initiative. This paper aims to analyze the influence that the Belt and Road Initiative has had on the political, economic, and cultural development of Latin America from 2013 to 2022. To do so, this paper will first identify the diplomatic relations between Latin America and China and their contribution to the evolution of BRI in the region. Subsequently, it will characterize the development of the Sino-Latin American trade relations and how they have been influenced by the region's incorporation into the project. Finally, it will describe the cultural interactions between China and Latin America and the way that they represent a benefit or challenge for the optimal performance of BRI in the region. The research used a qualitative method, with a descriptive scope and inductive logic. Moreover, the instrument of the collection is the reading card, and the instrument of analysis is the documentary analysis. Results show that BRI has brought China and Latin America closer, encouraging the participation of the Asian country in more and more projects that have been developed in the country, nonetheless, it has contributed to the widening of the economic gap in Latin America due to the asymmetric relation. Undoubtedly, the Sino-LAC relation continues to strengthen the political and cultural scenarios, bringing the two distant geographic spaces closer.

Keywords: China, Economic and Social Development, Latin America, Politics, Regional Cooperation.
JEL: F50, F69, O53, O54, O57

1. Introduction

The Belt and Road Initiative (BRI) is a global infrastructure project announced by Chinese President Xi Jinping in 2013. This seeks to revive the historic Silk Road and adapt it to the present day, through trade routes throughout Asia, Europe, and Africa as well as new maritime routes (Kuo and Kommenda, 2018). The ancient Silk Road was a network of routes used for commerce that linked South and Central Asia with Europe and the Middle East. It came during the westward expansion of China's Han Dynasty (206 BCE–220 CE) when the nation opened to trade (McBride, 2015). The Silk Road forged trade networks throughout Central Asia and eventually with Europe, extending the routes to over four thousand miles (McBride, 2015).

The establishment of these trade routes allowed Central Asia to become one of the first regions in which a kind of globalization was manifested as it was able to connect the Eastern markets with the Western markets at the time (McBride, 2015). This allowed the economic strengthening of these regions, cultural and religious interactions, as well as the exchanges of goods of high importance in, such as Chinese silk, spices, and jade (McBride, 2015). This ancient concept of the Silk Road was pursued once again by the Chinese Government, with the announcement of the modern initiative BRI, which was intended to begin on two occasions by the president. The first of these attempts was in Kazakhstan on September 7, 2013, when President Xi Jinping proposed the development of the New Silk Road Economic Belt which would connect China to Europe through land routes (Jenkins, 2021). Subsequently in Indonesia, where he announced the 21st century Maritime Silk Road Plan, which would connect China with all of Southeast Asia, the Middle East, and part of Africa. (Jenkins, 2021). This initiative enables development for the countries involved in the project and seeks to expand and fortify the superpower's global influence. From a political point of view, the implementation of international projects such as BRI allows cooperation between countries. This improves diplomatic relations, favoring populations in a multilateral way, and seeks a common good between states to improve the quality of life of their inhabitants and the progress of nations. As soon as the BRI project was launched, Western analysts made comparisons with the Marshall Plan explaining through the example of how China eventually gained the power of Sri Lanka's port after their insertion in this pact (Lim and Mukherjee, 2018).

However, Sino-Latin American relations existed beforehand. It was only until January 2018 that China invited Latin American countries to join the BRI

at the Economic Commission for Latin America and the Caribbean (ECLAC) Ministerial Forum in Santiago, Chile (Jenkins, 2021). The existent asymmetry of economic growth is evident in this relationship, China and Latin America and the Caribbean differ in their productivity and distribution of wealth. Therefore, being an economic partner entails a risk for both parties since LAC's economic development and relations rely on their natural resources. This represents a risk since LAC depends to a great extent on prices and resources availability, which does not guarantee future regional wealth (Armony, 2012). Undeniably, China needs LAC, since this territory produces natural resources, such as oil, copper, iron, and soybeans (da Rocha and Bielschowsky, 2018). According to ECLAC, these are the products that China imports most from LAC, representing more than 70 percent of the country's imports from this region (da Rocha and Bielschowsky, 2018). Benefits for LAC are of asymmetrical nature as well. This is materialized in the difference between countries, such as Brazil, Chile, Argentina, and Peru, whose economies are also commodity-producing, interacts in a deeper way with China while not all countries enjoy this status. For instance, the case of Central American and Caribbean countries cannot be favored by trade with China unless they can find a niche market, as is the case of Costa Rica with coffee (Armony, 2012).

While this association creates closer Sino-LAC economic and political relationships, it also enables cultural development. China has willingly developed educational programs such as Confucius Institutes in the continent. LAC, meanwhile, has an increasing amount of student exchanges offered by their universities and associations. In addition, both parties have faced involuntary mechanisms where they must interchange, such as the cultural differences present at the business level, an aspect that China needs to understand to have success in foreign business. On the counterpart, Latin America must understand China's political, financial, and educational initiatives, in the function of creating its own mindset, a plan for the future, and complementary, better understanding and symmetrical relationships (Peters, 2015).

Thus, the main hypothesis of this research explores the Sino-LAC asymmetrical relation, in which China ends up obtaining the most benefits which is shaped by the Chinese global strategy of governance and connectivity, especially with the most distant territory. Reaching agreements and partnerships with individual Latin American countries is the most feasible option, especially creating a belt that connects through the Panamericana Road along the Pacific coast.

Due to the previously named challenges, opportunities, and difficulties, this paper aims to explore the implications that BRI has had on the political, economic, and cultural development of Latin America in the period 2013–2022. This will enable the identification of Sino-Latin American diplomatic relations and how they contributed to the evolution of the BRI in the region, characterize the development of trade relations, and describe the cultural interactions between China and Latin America, having in mind the possible benefits or challenges for the optimal performance of the BRI in the region.

This paper has seven sections. After this introduction, the first two present the literature review and methodology. The fourth section explains the political relations since BRI. The fifth describes the economic relations, followed by the cultural interactions. The last section presents the concluding remarks that gather the complexity of the asymmetrical relation between China and LAC. This is followed by the references.

2. Literature Review

Since 2018, the number of articles published about the BRI in English has increased. This has created a gap between the topics covered by the papers written in Chinese and those in English, the texts written in English are focusing on critically examining the BRI and its geopolitical significance, while in the other language, the texts that can be found are mostly trying to interpret the best way to implement this initiative in practice (Liu and Yao, 2021). In addition, it is confusing to understand the BRI classification of Chinese projects because both official documents and the Chinese media have listed various projects with the BRI prefix; however, the government itself has not provided an answer as to the definitions or criteria used for such a classification (Liu and Yao, 2021). Undoubtedly, BRI is a topic of interest all around the world, and its interpretation implies taking positions in favor or against it.

Within the context of the BRI, developing countries play a fundamental role in the performance of this initiative. As stated by Nguyen Thi Thuy Trang (2020), most of the countries involved in the initiative are developing ones. Although their incorporation could bring benefits for their territories and economies, such as free trade and infrastructure development, their participation could lead to economic, political, and security risks since BRI can also be seen as a Chinese strategy to extend its influence around the globe (Trang, 2020).

In diplomatic terms, the incorporation of LAC into BRI can also endanger LAC's ties to the United States due to the existing rivalry between the superpowers. Some Central American and Caribbean countries that still have diplomatic ties with Taiwan have also studied the possibility of changing this situation to establish diplomatic relations with the People's Republic of China in order to participate in the BRI (Small, 2020). BRI is appealing due to its win-win principle which has led Beijing to devote a significant number of resources to its development and expansion (González-Sáez, 2019).

On a different note, BRI has been compared to the Marshall Plan. Both projects are unrelated, and their onset differs. The Marshall Plan proposed the possibility to terminate the program in the event that a participating country changed the alignment of its interests, whereas any participating country of BRI is respected in their positions and autonomy (González-Sáez, 2019). In addition, while the US plan sought to rebuild after a great war, the Chinese initiative aims to prevent a war through the inclusion in a development project (González-Sáez, 2019). From a more general perspective, Liu and Yao state that projects connected to China and within the BRI member countries can be categorized as BRI projects, whether they are Chinese-funded projects or Chinese foreign direct investments (Liu and Yao, 2021). However, only projects derived from, or included in the dialogues and cooperation between China and BRI countries should be named BRI projects, since they have a key feature of the BRI which is international cooperation (Liu et al., 2020).

Finally, Ferchen (2021) emphasizes the dynamics and nature of Sino-Latin American relations prior to the incorporation of Latin America into the project, emphasizing the region's dependence on commodities and its exports to China. It also questions the sustainability of this project in the region due to the tradition it has carried over the last few years in its exports as well as the environmental problems and impacts on local communities that the BRI could bring during the development of its works (Ferchen, 2021). This casts doubt on the long-term feasibility and benefits of this project in the western part of the world.

3. Methodology

This research is qualitative since it uses data collection, which is directly connected to documentary analysis, and analysis to clarify the research question or

to reveal new inquiries during the interpretation process, based on the previously stated theories (Hernández Sampieri, Fernández Collado and Baptista Lucio, 2014). The scope is descriptive and logic inductive because it seeks to specify properties and characteristics of any phenomenon to be analyzed, recollecting information from different sources and authors which allows the description of tendencies of a group or population to answer the research question.

The documentary analysis allows the efficient use of different sources of information. According to Bowen (2009), this consists of a systematic method of document review or evaluation that uses a wide variety of primary and secondary sources, allowing different perspectives to be obtained and validating a point of view without possible biases. For this research a collection of different resources, such as videos, documents, web pages, articles, and others were used to respond to the objectives of the thesis, then the collection and analysis of the information found were divided into the three main themes of the thesis: diplomatic relations, trade relations and cultural interaction between Latin America and China.

4. Sino-LAC Diplomatic Relations, a Question about BRI's Effective Contribution

The development of diplomatic relations between China and LAC countries has led to a greater participation of the Asian giant in multiple projects in the region. This evolution has facilitated China to join different international organizations, such as the admission to the Organization of American States (OAS) as a permanent observer in 2004, the annex to the Inter-American Development Bank (IDB), and the creation of the China-ECLAC Cooperation Forum. The Forum was first held in January 2015. This worked as a mechanism of communication and agreements for high-level mandataries of China and ECLAC country members. This event is a milestone for the materialization of cooperation as it was the first formal meeting about BRI with LAC. This facilitated the creation of a mid-term plan of collaboration, which was divided into two stages: the first in the period 2015–2019 and the second in 2022–2024 (China-CELAC Forum, 2016). The main topics covered by the first cooperation plan are divided into thirteen areas which can be cataloged into three main aspects: international relationships, industry, and the human aspect. International relationships gather three aspects: 1) politics and security which implies improving teamwork and dialogue between both parties in terms of solving judicial, consular, migration, and cyber security issues through the incentive of dialogue and meetings; 2) international affairs that aim

to strengthen institutions and collaboration in the global economy, sustainability, and negotiations on climate change; and 3) trade, investment, and finance, to promote business between the two parties in fields such as high technology and value-added goods production through the enhancement of partnerships, ventures, and collaboration between financial institutions (China-CELAC Forum, 2016).

Moving on to the second area (II), the cooperation plan is related to the management and planning of how to improve the production of and develop the industry, promoting the subjects of infrastructure and transportation by 4) incentive infrastructure projects in terms of maritime and land routes to facilitate logistics and urban development. In terms of 5) energy and resources, the cooperation plan seeks to enhance collaboration with the possibility of new forums and agreements in terms of energy, mining, electricity, and sustainable use of resources. In 6) agriculture, the plan promotes a new technology that benefits the management of livestock and terrain, while keeping and strengthening actual and new partnerships and forums related to this topic. Finally, the plan aims to expand the know-how in 7) high technology areas, the information industry, and scientific and technological research to guarantee sustainable production, better risk management, prevention of climate change, and improvement of the way production is held (China-CELAC Forum, 2016).

Lastly, the third area (III) of the cooperation plan handles topics of human concern. This includes 8) education and training of human resources by the promotion of exchanges and cooperation between education departments and institutions to have a better knowledge transfer. In terms of 9) culture and sports, the plan aims to encourage events that facilitate interaction between China and Latin America in order to preserve and promote art, sport, and cultural heritage. Under the topic 10) press, media, and publication the plan also seeks to facilitate information trade, build better networks, and dismantle the language barrier. In 11) tourism, the cooperation plan encourages collaboration between governmental tourist departments in order to promote a two-way investment in tourism. Regarding 12) environmental protection, disaster risk and management and reduction, poverty eradication, and health, the plan aims to enhance cooperation in order to guarantee a sustainable use of resources, biodiversity protection, natural disaster management, and food distribution. Finally, the plan seeks to increase interaction between several civil groups, such as academic institutions, forums, women organizations, and others, in order to promote 13) people-to-people friendship (China-CELAC Forum, 2016).

Both sides created sub-divisions according to specific fields to create platforms and strengthen cooperation and exchange through these sub-forums. By March 2016, these sub-forums were established, such as the China-Latin American and Caribbean Regional Agricultural Ministers' Forum, Scientific and Technological Innovation Forum, Political Parties Forum, Infrastructure Cooperation Forum, Region Young Political Leaders` Forum, The Forum of Interchange between China-Latin American and Caribbean Regional Think Tanks, Business Summit, People and Friendship Forum and the Legal Forum (China-CELAC Forum, 2016).

Based on the aforementioned, the Sino-LAC relationship has reached treaties and agreements that comply with principles of flexibility and voluntary participation. Thus, every state has the right to enter or refuse their inclusion in an initiative. In addition, new agreements do not replace previous commitments, they must be decided by mutual will, and respect each party's own policies and national legal system, thus respecting the sovereignty of each member country of the forum. Moreover, the plan states that it should also include special consideration for the least developed countries, but there are no concrete measures that would guarantee this (China-CELAC Forum, 2016).

On the one hand, as the 18th National Congress was held, the strengthening between both parties is aimed to grow through established visits with several states from Latin America, and new meetings with officials from new partners. This was materialized by three trips to Latin America by the Chinese president, Xi Jinping including the first official visit to 11 heads of state of Latin American and Caribbean countries in the period from 2014 to 2016. In addition, at the meeting with Latin American and Caribbean leaders, the Chinese president announced to the countries present an invitation of 1,000 heads of different political groups from the western continent to visit China during the period of 2015–2019. This initiative, included in the Cooperation plan between China and ECLAC, was carried out by the Central Committee of the Chinese Communist Party, resulting in a total of 250 members in 16 groups that visited China during 2015 in order to assist with the first edition of the China-Latin America and the Caribbean Political Parties Forum, which took place in Beijing from December 7th to the 9th of the same year, where the topic discussed was of strengthening the trade of experience of management in governmental and administrative issues, concluding in a new invitation for 2016–2020 (China-CELAC Forum, 2016).

On the other hand, new integral bilateral relationships with China emerged, such as the ones with Peru, Mexico, Argentina, Venezuela, Ecuador, and Chile which

followed a previous relationship founded between China and Brazil. Additionally, in terms of partnership and cooperation, it is also worth mentioning the incorporation of seven Latin American countries with the Asian Infrastructure Investment Bank (AIIB) which seeks to improve cooperation through sustainable development by investing in infrastructure (China-CELAC Forum, 2018). Another tool that seeks deeper interaction between Latin America and China is the Food and Agriculture Organization (FAO) regional plan which, if implemented, will promote the insertion of China in Latin American agriculture plan, where the Asian country will be present in terms of giving knowledge and technology in the agricultural process, but at the same time, presence in digitalization and an e-commerce platform that may allow China to collect information about Latin Americas management, production and use of their resources (FAO, 2022).

Furthermore, with the third ministerial meeting of the China-ECLAC held in December 2021, the attending countries agreed to adopt the cooperation plan for the period 2022–2024 which sought to promote cooperation in the previous key areas. For the implementation of this plan, it is intended to be developed in a flexible and voluntary manner and not to affect any previously agreed cooperation project, nor would it replace the decisions and actions taken with the multilateral agreements. In the same way, the decisions and activities should be carried out by common agreement and according to the availability of financial factors and human talent (Ministry of Foreign Affairs, 2021). As the second plan goes, this will be focused on six similar topics that engage in the previous aspects of the first plan. The topics are: 1) Political and Security Cooperation, 2) Economic and Pragmatic Cooperation, 3) Cooperation on High-Quality Infrastructure, 4) Social, Cultural, and People to People Cooperation, 5) Sustainable Development, 6) International Affairs and Sub-regional and Inter-regional Cooperation (China-CELAC Forum, 2021). Although both plans seek to foster economic, trade, and political cooperation, there are some key differences between them in their areas of focus, investment amount, and time frame. In terms of the areas, the first plan was highly focused on areas such as trade, investment, and agriculture. While the second plan moved deeper into digitalization, science, technology, and environmental protection, as it upgraded promoting dialogue to construction, investment, and concrete projects implementation in this field. In addition, time frames and investment differ, being 5 years and an amount of US$35 billion for the first one, and 3 years without a specific investment amount for the second (China-CELAC Forum, 2021).

As these plans were held in the time frame from 2015 to 2024, looking to the past from the actual year 2023, shows that there are no concrete realizations of these. Particularly, being the tenth anniversary of the China-proposed Belt and Road Initiative enables the world to question the efficiency of the initiative after this period, as it currently has a closer look at its development, the country of China and its strategy (Wenxing and Jun, 2023).

The progress in diplomatic relations between China and Latin America has allowed the establishment of this platform for both parties in which they can continue to promote their cooperation and the creation of new projects and agreements in order to obtain a mutual benefit, as has been the plan established since the China-CELAC forum, in which different plans have been promoted in critical areas for the development of both regions; however, little has really been found about the actions that have already materialized, apart from the documents and visits made. The documentary analysis does not seem to yield enough information to state with certainty that there has been significant progress and implementation in the plans mentioned above, which leaves real economic development on hold through cooperation that has been promised since the forum. Therefore, it is necessary to approach the subject from another perspective, covering China's intentions and its strategy with the development of these plans, to obtain more precise information about the materialization of these agreements.

5. Sino-LAC Trade amidst BRI

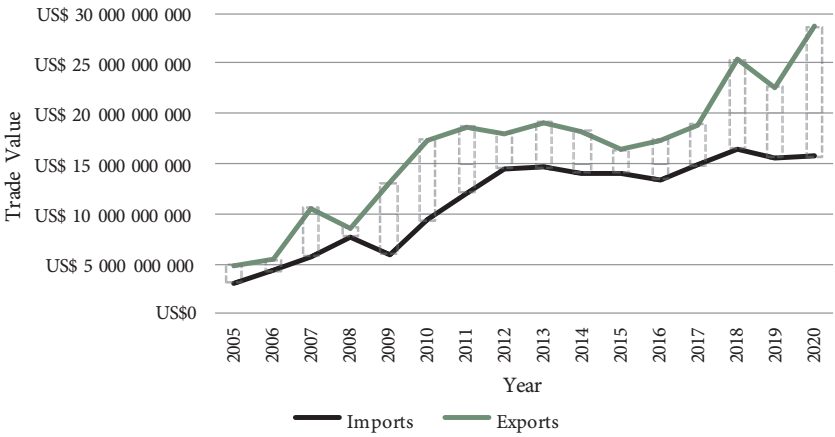
Since the incorporation of Latin America into the Belt and Road Initiative, there has been an evolution in terms of trade aimed at greater interaction and integration. Currently, there are free trade agreements established between the Asian giant and three Latin American countries, namely Chile, Peru, and Costa Rica; these agreements were signed in 2005, 2009, and 2011 respectively, and the evolution of these treaties is evident due to the increased presence of China as a trading partner both in terms of imports and exports (MOFCOM, 2011; MOFCOM, 2019; MOFCOM, 2020).

Additionally, on February 16, 2023, negotiations for a potential free trade agreement (FTA) between the Republic of Ecuador and China were concluded after a year of being launched; a new free trade agreement between Panama and China is also being negotiated, as of January 2018 to date, five rounds of negotiations have been held in the cities of Beijing and Panama City (MOFCOM, 2019; MOFCOM,

2023). Finally, the possibility of establishing a trade agreement between China and Colombia, one of the superpower's main partners in the region, has also been studied.

Contrastingly, the Sino-Chilean FTA has had a positive and constant evolution (see Figure 1). This has allowed the relationship to maintain a positive balance of payments since the agreement came into force; exports from Chile to China have had a constant upward trend, reaching a maximum of exports in 2020 for a value of US$28.6 billion (OEC, 2023). Similarly, imports from the Asian country have slowly reached a positive result since the agreement came into place. These reached a maximum of US$16.5 billion in 2018, and by 2020 the value of imports was 15.7 billion, thus concluding with a positive difference of US$12.9 billion for Chile (OEC, 2023).

Figure 1. Trade Balance for Chile to China



Source: Data Adapted from the Observatory of Economic Complexity (OEC).

This agreement between the two countries began negotiations in June 2002, thanks to China's proposals made to the Chilean government. The FTA has consisted of a progressive negotiation which has been divided into four main stages which are: an FTA based on goods which was signed in November 2005 and subsequently entered into force in October of the following year; a supplementary agreement on trade in services which entered into force in August 2010; a supplementary agreement on investment which entered into force in 2014; and finally, a deepening of the FTA in 2017 which entered into force in 2019 (MOFCOM, 2020).

Furthermore, the trade agreement between Peru and China, which was signed in April 2009 and entered into force on March 1, 2010, has allowed for closer relations between the Latin American country and the Asian superpower, leading to greater access to the Chinese market in recent years through increased demand for consumer goods, raw materials, intermediate goods, and capital goods.

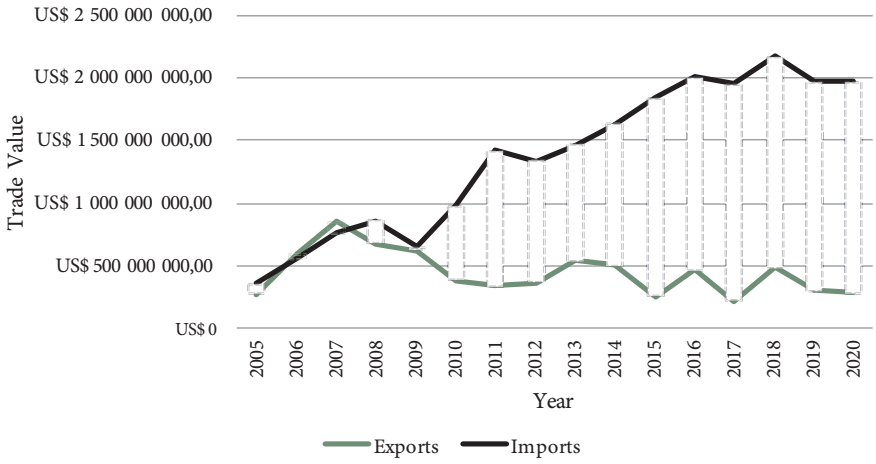
Figure 2. Trade Balance for Peru to China

Source: Data Adapted from the Observatory of Economic Complexity (OEC).

Since the FTA between China and Peru came into force, there has been a notable expansion in trade between the two countries (see Figure 2), with an increase in both imports and exports. This has allowed China to position itself as the main trading partner of the South American country, being the largest destination for Peruvian exports in terms of mining and fishing (Ministerio de Comercio Exterior y Turismo, 2022). For Peru, both imports and exports with China have had positive behaviors since the FTA came into effect; with a higher export volume of exports over imports, only surpassed by the period between 2012 and 2016, shipments from Peru to China have reached a maximum value of US$13.8 billion by 2019; However, by 2020, these had a drop of more than US$2 billion compared to the previous year (OEC 2023). Now, Peru's imports from China have had a similar behavior to exports although not at the same rate since 2016, in which imports had less fluctuation, these reached a maximum of US$10.2 billion, and despite not being as abrupt as in the case of exports, these also had a decrease by 2020 to a total value of US$9.91 billion (OEC 2023).

Unlike the two previously mentioned countries, the behavior of the trade balance between China and Costa Rica has had completely the opposite behavior (see Figure 3). Imports from Costa Rica exceed the Chinese by 687 percent, Costa Rica has a deficit balance with respect to China.

Figure 3. Trade Balance for Costa Rica to China



Source: Data Adapted from the Observatory of Economic Complexity (OEC).

Contrary to the two previously mentioned FTAs, the trade relationship between Costa Rica and China is clearly disproportionate in terms of the trade balance of both countries. The gap for Costa Rica has widened on an ever-increasing scale since the treaty came into force in 2011, the deficit between imports and exports has left the Central American country at a clear disadvantage versus China.

Additionally, to date, the Chinese government is in the process of negotiating the establishment of FTAs with two Latin American countries. On the one hand, in the case of Panama, the establishment of such an agreement would be highly beneficial for the Eastern part, since China is positioned in second place as one of the main trading partners of the Central American nation as well as the second largest user of the Panama Canal (MOFCOM, 2018). With a trade balance of 100 percent deficit for Panama in terms of trade with China in which imports presented a value of US$8.8 billion by 2020, compared to total exports worth of only US$450 million, the establishment of a free trade agreement between the two countries would end up being completely disadvantageous for Panama as

it would continue to aggravate the already existing gap in the trade balance of both countries, worsening the unequal situation that these countries present in favor of China (OEC, 2023). On the other hand, the negotiations between China and Ecuador for the establishment of the FTA between the two nations were concluded after a year, seeking to carry out all the follow-up work, translation, and other processes to start the treaty as soon as possible. According to the Ministry of Commerce of China (2023), bilateral trade with Ecuador by 2022 reached US$13 trillion, including a year-on-year growth of 20 percent; this FTA would have the potential to strengthen not only trade relations between the two countries but also to increase cooperation between them. In addition, according to data obtained from the OEC, although the trade balance between the two countries had the same tendency as countries such as Panama or Costa Rica, in recent years the gap has closed more and more, going from a gap between imports and exports of US$3.72 billion for 2013 to about US$860 million (OEC, 2023).

In the case of Colombia, a joint feasibility study for a future FTA with China is being carried out, however, no further information was found on the government pages of the Ministries of Commerce of both China and Colombia. At the same time, the trade balance for Colombia vis-à-vis China, as well as countries such as Costa Rica and Ecuador also have a deficit behavior with imports from China being noticeably higher compared to Colombian exports to China, which double their value, putting Colombia at a disadvantage due to the asymmetric trade relationship (OEC, 2023).

Lastly, according to the World Integrated Trade Solution (WITS) (2023), by 2022, Brazil was positioned as China's main trading partner throughout Latin America and ranked sixth globally. Since 2009, the Latin American giant has destined most of its exports to the Eastern superpower (see Figure 4) due to China's high demand for commodities and energy resources as well as China's imports of manufactured goods and technology to Brazil (Valls, 2017).

In short, it is evident that an asymmetric trade relationship exists between China and some Latin American countries in which the Asian country has the dominant position. This is mainly due to the types of products that China imports from the New World region since they are goods with little or no added value, while on the part of Latin America the most imported products from China are machinery and electronic equipment (Perrotti, 2015, p. 4).

Figure 4: Trade Balance for Brazil to China

Source: Data Adapted from the Observatory of Economic Complexity (OEC).

Additionally, the creation of these FTAs with some countries, such as Costa Rica and the potential treaties with Panama and Ecuador, would be counterproductive for Latin American countries due to the position they currently assume since they would allow the import of Chinese products at even lower prices due to the reduction or elimination of tariffs, resulting in an increasingly difficult competition for local production in the region. It is necessary that Latin American countries seek to diversify their exports and establish more balanced trade agreements to reduce the negative impacts of this unbalanced trade relationship.

6. Cultural Interactions, a Challenge for BRI's Performance

BRI involves the interaction of two groups with strong cultural differences which can make it difficult to interact, cooperate and even, in greater depth, create a serious challenge for the optimal development of the project. The strong geographical and cultural distance that both parties have historically presented has been a brake on interaction and communication between the Asian country and the region belonging to the new world.

While Chinese culture is strongly influenced by the roots of Confucianism, it also has its own traditions, institutions, and history which is strongly rooted in the country, while the culture in Latin American countries is mostly based on

Spanish colonialism and its adaptation to the western world. This has caused the way of acting, thinking, and seeing the world to differ greatly. For the Chinese culture, tradition and modernization are important. As for the first one, they follow the Confucianism principles of timelessness, hierarchical structure, collective trust, and reciprocity, while the second one is influenced by western ideas plus the internal ideology of perfection, pushing them to pursue continual improvement in order to be the best competitor worldwide. Additionally, they value learning and self-ethical improvement as those concepts reign their own path, having responsibility for their acts and their own search for perfection. Furthermore, their society is based on preserving filiality as it provides family unity, which is connected to governmental or state-related institutions and endeavors, thus, creating a trust chain that works on a national collectiveness (Tanco Armero, 1861/2013).

Latin American countries are the product of diverse historical influences and collective decisions, such as Spanish colonialism and the global powers, shaping this cultural hybrid in economic, political, social, and cultural aspects. Due to the Spanish influence, society was based on a historical division of heritage and lineage, provided by Spain's original form of categorizing their citizens, which works contrary to the indigenous culture. This influence also caused a historical, economic, and political dependence on others in decision-making, plus being the provider of natural resources to the world, stronger countries take advantage of Latin America's lack of identity and long-term strategy in the global scheme which, nowadays, is still an issue that the continent tries to define and solve.

The previous description of China's culture implies that the Asian country is currently a more united nation in comparison to the Latin American scenario that still struggles to define its identity. Furthermore, China has a clear and common long-term objective involving political, economic, and cultural expansion, while its counterpart lacks a clear course of development. Also, in the aspect of collectivism both cultures differ, as the first one is centered on nationwide collectivism and union, while Latin American countries do not have this concept, as when there is a sense of union, it is more related to the family spectrum, creating an individualism of multiple familiar cores.

The findings above show the need for the Sino-Latin American relationship to better understand historical problems in order to interact and cooperate, therefore, implementing proper strategies in fields of education, institutions, connectivity, and others. It is for this reason that China has sought strategies for Latin America to have, in a certain way, an approach to this oriental culture through the

learning of the Mandarin language by means of the implementation of Confucius Institutes in various cities of the continent.

For the year of 2016, the Confucius Institute reached a number of 500 centers worldwide (Confucius Institute Headquarters, 2016). The function of these institutes is to expand the knowledge of the Chinese Language and culture in other countries, while trying to use flexible teaching patterns and adapt to local conditions in foreign primary schools, secondary schools, communities, and enterprises (Confucius Institute Headquarters, 2016). Furthermore, the Confucius Institute Headquarters (Hanban) is responsible for the evaluation, approval, and foundation of new institutes, managing the budget for new projects, conferences, and support for other establishments, alliances with other entities and finally, defining the teaching content, its evaluation, activities, and staff to accomplish the educational objectives (Confucius Institute Headquarters, 2016).

The development of this initiative was materialized in 2004 with the first founded C.I. headquarter in a foreign land, particularly in the USA which was followed by the first institute established in Latin America in 2006 in Mexico (Confucius Institute Headquarters, 2016). In 2014, representing a deeper insertion in the LAC sector, comes the second headquarters, which was established in Santiago de Chile. Thus, through diverse projects on the continent, at the end of 2015, there were already 39 Confucius Institutes and 14 Confucius Classrooms in Latin America (China-CELAC, 2016).

In terms of how these initiatives have affected the performance of the BRI in the region, it can be said that this works as a tool that aims to solve the topic from the first plan, related to education and human resources training, keeping in mind the knowledge transference while also serving purposes from technical, relational, and strategical aspects (China-CELAC, 2016). Firstly, for the technical purpose, the growing amount of people learning Chinese language and culture has increased due to the establishment of these institutes, serving as a base to improve the understanding of Latin Americans of China, and the capability of improving its communicational knowledge with it (Dussel Peters, 2015).

As the previous works as a benefit for mutual understanding, the relational purpose tends to benefit the Asian country in a deeper way, as these institutions have the potential to show an impartial image of China in Latin America by avoiding certain delicate global issues or explaining them through a prism that lessens any possibility of forming a negative perspective on China (Rubiano, 2019). Finally,

the main purpose of these foundations through CELAC countries, appear as a strategic benefit for China, acting as part of an aggressive global strategy to assert China´s presence in countries critical to China´s long-term interests (Dussel Peters, 2015). Thus, the call is to be cautious since China´s presence, influence, and footprint marks the perception of future generations and gives territorial power to China in Latin America (Dussel Peters, 2015).

7. Concluding Remarks

The slow-pacing Sino-LAC relation has revolved around the political and economic spheres, favoring the asymmetry that leans toward China. Clearly, LAC is willing to consider the future advantages of such a relationship, especially given the autonomy in decision-making processes that otherwise have been denied by the western development speech. Thus, LAC is measuring up how to make the most out of the Chinese relations without giving up western privileges.

Undeniably, LAC is aware of the drawbacks of the negative trade balance with China, but also of the future benefits considering FTAs. Chile and Peru have been considered winners of such a formula whereas Costa Rica is challenged by the exchange. However, countries, such as Ecuador and Colombia want to join the possibility to explore the Chinese market, and its endless possibilities. Perhaps LAC is switching from the American to the Chinese dream.

To do this, culture is a must, not as an intervention but as an understanding. The Chinese culture has been presented as the possibility to learn how to interact with China, with no need to change ways of life, thinking, or behaving. Thus, the gap or cultural distance of the Sino-LAC relation is being closed by the education of language and tradition through the Confucius Institutes.

One of the questioning issues is how China is approaching LAC geographically or geopolitically. Considering the evidence of FTAs solely, the study and approval of these agreements have been concentrated on countries located along the Pacific coast, that is, Costa Rica, Panama, Colombia, Ecuador, Peru, and Chile. These countries form part of the Pan-American Highway, which links almost the entire continent from north to south, except for a stretch in the Darien region, which is shared between the territories of Colombia and Panama. Therefore, BRI connectivity can be guaranteed in the future, especially because of port facilities in the countries.

China is shaping up the path of how BRI can connect LAC using political, economic, and cultural mechanisms. The existing gap is meant to be closed within time as connectivity becomes a reality in the Pacific area. Once again, LAC is moving willingly in a pendulum of power, betting on a future that should have positive rewards on the eastern side and receiving western critiques on the other. In the end, only results in the long-term and the game of global power would tell if the Chinese strategies and mechanisms for expanding BRI were truly effective.

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Vietnam's Response to a Call for a Renewable Energy Revolution in the Context of Trade Integration: What Could be Learnt from the EU?

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Abstract: The use of renewable energy, for many economies around the world, is considered a key pillar in creating the foundation to pave the way to green growth and sustainable economic development, to adapt to climate change. Not only has it been affirmed recently during regional and global meetings, but renewable energy development continues to be one of the main concerns reflected in many free trade agreements, typically European Union–Vietnam Free Trade Agreement (EVFTA) concluded by the EU with Vietnam. Under this agreement, member states, including Vietnam, are required to reduce their traditional coal-fired power plants in favor of cleaner or renewable energy sources. This study aims to examine the implementation of the commitment to use renewable energy as the preferred alternative in EVFTA under the principle of *pacta sunt servanda* and the government's responsibility to comply with international treaties. Accordingly, it is necessary to implement suitable solutions to fulfil the mentioned commitment properly as a state member. By using the analysis and synthesis method, this article focuses on studying the provisions of the EVFTA, current Vietnamese law, the EU's policies, and regulations, as well as the laws of some EU countries on renewable energy development. This study, by using a comparative method, indicates compatibility between the EU's policies and regulations and the laws of some EU countries. Similarly, it compares and evaluates relevant mechanisms and policies between Vietnamese law and the laws of some EU countries. As a result, some recommendations are proposed to improve the effective implementation in encouraging the growth of renewable energy in Vietnam, towards building a green and environmentally friendly economy.

Keywords: renewable energy, EVFTA, EU, Vietnam, green growth
JEL: K32, K33, Q01, Q48, Q56

1. Introduction

Climate change, as one of the biggest challenges of our times, has been identified as endangering regional and global security as well as the major advancements made by humanity at present and in the future. Recognizing climate change and its severe impacts on human lives, countries, including Vietnam, have been working together to control this global issue by finding solutions to combat climate change in the context of current trade integration. Renewable energy development is one of the measures sought by countries. In addition to actively participating in international treaties on climate change, such as the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol, and the Paris Agreement, countries have negotiated and agreed to include provisions related to the fight against climate change as well as the development of renewable energy in free trade agreements.

In tune with the general trend, on June 30, 2019, Vietnam signed a free trade agreement with the European Union (EU). This agreement entered into force on August 1, 2020, with the desire to create a common driving force to promote economic growth as well as sustainable development. In particular, in the field of environmental protection and the fight against climate change, the EVFTA requires members, including Vietnam, to cut down on traditional coal-fired power plants and replace them with clean and renewable energy sources. The requirement for renewable energy development is getting more and more attention as Vietnam has shown its determination through strong commitments at the 26th United Nations Conference on Climate Change (COP26) and recently, COP27. However, at present, the development of renewable energy, especially solar and wind energy, still has many challenges to overcome.

This study conducted an in-depth analysis of Vietnam's response to a call for a renewable energy revolution in the context of trade integration. Accordingly, Vietnam has become a member of the EVFTA, and as a result, Vietnam has to implement commitments to develop renewable energy that are stated in the EVFTA. The primary purpose of this study was to examine the implementation of the commitment to renewable energy development in EVFTA under the principle of pacta sunt servanda, and the government's responsibility to comply with international treaties according to the 2013 Vietnam Constitution. Based on the obligations arising from international treaties, Vietnam must comply with all commitments agreed upon as a state member. Consequently, it is crucial to

apply suitable measures to implement these commitments properly, especially the growth of renewable energy, according to the EVFTA.

This paper comprises four parts of the main discussion. The first part presents an overview of renewable energy development under EVFTA by indicating the relation and interaction between the growth of renewable energy, trade integration, and renewable energy provisions in EVFTA. The second part examines whether the EU members, namely Germany and Spain, are doing well in renewable energy development due to being EU members as well as EVFTA's member states. The third part clarifies renewable energy development under Vietnamese law. Finally, some suggestions are provided to ensure the effective implementation of the commitment to develop renewable energy in the EVFTA based on learning from Germany and Spain.

2. Methods

This study used comparative and evaluative methods to analyze and examine the provisions for developing renewable energy in EVFTA, the EU's policies and regulations, German and Spanish legal frameworks, as well as Vietnam's legal system. The authors selected applicable laws, including international treaties and documents, focusing on EVFTA and the EU's policies and regulations, German, Spanish, and Vietnamese laws on renewable energy, and practices on the growth of renewable energy in Germany, Spain, and Vietnam in the context of trade integration, in three steps. First, studying the growth of renewable energy and trade integration. It provided a rationale for assessing the inclusion of provisions related to renewable energy in EVFTA. Second, examining the growth of renewable energy in the EU's policies and regulations as well as in the legal frameworks of some EU members, namely Germany and Spain, by using comparative and empirical methods. Third, with the analyzed method, this study identified the growth of renewable energy within the Vietnamese legal system. It contributed to proposing suggestions to improve Vietnam's legal framework on renewable energy to implement the commitment to develop renewable energy effectively.

3. Overview of Renewable Energy Development under EVFTA

3.1. The Growth of Renewable Energy and Trade Integration

Renewable energy is frequently cited as the most important step the world can take to fend off the worst consequences of climate change. Unlike conventional energy sources, also known as fossil fuels, renewable energies are clean, inexhaustible, and, most importantly, they produce neither greenhouse gases nor any kind of pollution emissions (Acciona Business as Unusual, s.a.). This kind of energy has positive impacts on public health, the environment, and the economy. In terms of public health, renewable energy can basically overcome what fossil fuels do to human health. According to the World Health Organization, more than 13 million people die around the world each year due to avoidable environmental reasons, including air pollution (United Nations, s.a.). The unhealthy level of air is mainly caused by the burning of fossil fuels, mostly coal and natural gas. In 2018, air pollution from fossil fuels caused US$8 billion a day in health and economic costs (United Nations, s.a.). Thus, switching to renewable energy not only helps tackle the air pollution emitted by fossil fuels, but also improves the quality of human health. In other words, renewable energy is healthier. For the environment, using renewable energy is one of the most important actions to reduce its devastating effects and combat climate change. Producing no greenhouse gas emissions, which is an accelerating agent of climate change, and shifting to renewable sources could reduce the electricity sector's emissions by around 81 percent and bring down yearly greenhouse gas emissions by one-fifth (Union of Concerned Scientists, 2008). Regarding the economic benefits of using renewable energy, in addition to making economic sense by creating a system less prone to market shocks and improving resilience and energy security, more job opportunities are created. According to the International Energy Agency, the transition towards net-zero emissions will lead to an overall increase in energy sector jobs, and a total of more than 30 million jobs could be created in clean energy, efficiency, and low-emission technologies by 2030 (Cozzi and Motherway, 2021). By investing in clean energy, not only individuals but also local governments will benefit, including income taxes and other payments from project owners. In conclusion, renewable energy offers significant benefits ranging from economic to non-economic values, and it is powering a safer future for later generations.

Acknowledging the profound role of renewable energy in the fight against climate change, countries have been working together to boost renewable energy. In addition to discussing and agreeing on international agreements on climate

change that include renewable energy provisions, nations have been striving to incorporate climate change response provisions as well as provisions related to renewable energy into trade agreements. In other words, the relationship between trade and environmental protection is not new and has arisen as a result of recent trade agreements (Amaral and Martes, 2020, p. 389); rather, it has existed since 1970 (World Trade Organization, 1994). In 2009, the World Trade Organization and the United Nations Environment Program released a thorough report on trade and climate change that looked at the intersection between the two topics (World Trade Organization, 2009). This report analyzed the contribution of trade to mitigation and adaptation efforts to address climate change, the effects of trade on climate change, and vice versa (Amaral and Martes, 2021). It can be seen that trade can help fight climate change by speeding up the transmission of clean technologies and giving emerging economies the opportunity to customize these technologies for their own needs. To be more specific, in the context of trade integration, developed countries realize that developing countries desperately need trade incentives for economic development. As a result, these countries include commitments on renewable energy development or environmental protection in trade agreements as a reciprocal exchange to attract the developing countries' attention. Thus, there is a linkage, even if not a close one, between free trade and the environment in general and renewable energy development in particular, as well as an increasing number of trade agreements that incorporate provisions on these topics.

In summary, a correlation exists between the integration of trade and the growth of renewable energy resources. The explicit commitments that have been ratified in recent free trade agreements, such as the EVFTA, serve to underscore the significant interaction between the parties involved.

3.2. Renewable Energy Provisions in EVFTA

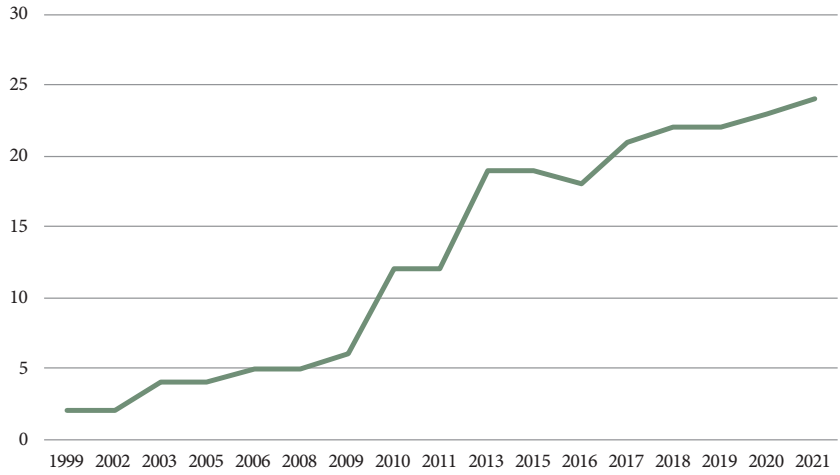
Renewable energy is distinctly mentioned in the two chapters of EVFTA, including Chapter 7 on Non-tariff barriers to trade and investment in renewable energy generation and Chapter 13 on Trade and sustainable development.

In terms of foreign investment, under Art. 7.1, the parties are committed to cooperate towards removing or reducing non-tariff barriers in the generation of energy from renewable and sustainable sources. To concretize this objective, the parties focus on non-discriminatory treatments in general, on local content in

particular, and further on the use of international standards (Delegation of the European Union to Vietnam, 2019). Accordingly, under Art. 7.4(a), a party shall refrain from adopting measures providing for local content requirements (LCRs) or any other offset affecting the other party's products, service suppliers, investors, or enterprises. In fact, LCRs are prohibited because, generally, they directly distort trade and encourage substituting imports with domestic goods, even if those domestic goods are inferior and more expensive than foreign imports, by requiring enterprises to use a minimum level of domestically manufactured goods or domestically supplied services. However, LCRs are recorded as a method that many countries apply due to their positive effects on domestic economies. According to a report published by the Organization for Economic Cooperation and Development, during the period 1999–2015, at least 21 countries planned or implemented LCRs in solar photovoltaics (PV) and wind energy, and these LCRs are commonly referred to as "green" LCRs (Hogan, 2021). Green LCRs are on the rise, as can be seen in Figure 1 below, and Germany has been on the list since 2021 based on the introduction of the Renewable Energy Act (Hogan, 2021). Germany obviously applies LCRs as of 2021, even though the obligation to refrain from adopting measures providing for LCRs officially binds the member states as of August 2020. This shows that Germany has invoked the exception to the above obligation when LCRs could be applied if there is no effect on the other party's products, service suppliers, investors, or enterprises. Thus, it can be seen that Art. 7.4(a) still opens the possibility of applying LCRs to create opportunities for member economies of the EVFTA to promote and encourage domestic production without violating these agreements' commitments.

In addition, Art. 7.4(b) EVFTA also requires that a party shall refrain from adopting measures requiring the formation of partnerships with local companies unless they are needed for technical reasons. This means requirements were establishing or operating a legal entity or partner under domestic law with a local company or entering into a contractual business partnership with a local company are not allowed. These requirements may increase the rate of return for domestic investors, maintain and strengthen control over foreign investors, or facilitate technology transfer through access to and collection of know-how from foreign investors. Moreover, under Art. 7.4(c), it is required to be objective, transparent, non-arbitrary, and non-discriminatory in any measures concerning the authorization, certification, and licensing procedures. These requirements aim to attract the attention of investors and build their trust while investing in projects related to renewable energies.

Figure 1. Number of countries that activated green LCRs during the period 1999–2021



Source: OECD, 2015.

For the effective implementation of removing or reducing non-tariff barriers to trade and investment in renewable energy generation, obligations on cooperation and information exchange are imposed. Being a provision on implementation and cooperation, nevertheless, Art. 7.7 does not set out a specific sanction for the party that violates any commitments in Chapter 7. It only transfers the obligations to the parties and sets up the supervision of the specialized committees and the Trade Committee. It can be seen that within the provisions on non-tariff barriers to trade and investment in renewable energy generation, there are no provisions referring to Chapter 15 on Dispute Settlement or Annex 15-C on Mediation Mechanism. Therefore, under EVFTA, if a party violated any provision related to non-tariff barriers to trade and investment in renewable energy generation, that party would not confront any serious legal consequences, such as the initiation of the arbitration procedure. Following this, due to not having any legal consequences in the case of violations, it is understandable when there is fear that parties may postpone implementing commitments under the EVFTA, including reducing or removing non-tariff barriers to trade and investment in renewable energy generation.

In relation to sustainable development, according to Art. 13.6, renewable energy is regulated as a measure to address the urgent threat of climate change. This kind of energy is clearly a great solution in the fight against climate change due to the fact

that it does not emit greenhouse gases, which contribute to global warming, and is not naturally replenished and does not run out. Under Art. 13.6.2(c) of EVFTA, the EU and Vietnam jointly recognize the obligation to conduct consultations as well as information and experience exchange in priority areas or areas of mutual interest, including renewable energy development. This obligation comes from the UNFCCC's membership as well as other international instruments related to climate change, such as the Kyoto Protocol and the Paris Agreement. Obviously, EVFTA does not introduce any new regulations or solutions but only reaffirms the commitments previously proposed in these international treaties. For instance, Art. 2(1)(a)(iv) of the Kyoto Protocol insists that each party, to promote sustainable development, shall implement measures including research on, promotion of, and increased use of new and renewable energy. Thus, it could be concluded that the development of renewable energy is quite generically regulated in EVFTA. In other words, in EVFTA, with its nature as a trade agreement, commercial aspects will take precedence over environmental regulations in general, or renewable energy development in particular. As a result, to obtain a comprehensive understanding of their obligations concerning renewable energy, it is crucial for the member states to refer to international treaties mentioned in Chapter 13 of the EVFTA.

Regarding monitoring mechanisms, the EVFTA provides for the establishment of domestic advisory groups (DAGs). Consisting of social partners and civil society organizations, DAGs are established to encourage the participation of the public and the different sectors of society in the promotion of sustainable development by ensuring a balanced representation from three main groups, namely employers, workers, and third sectors or non-governmental organizations (European Economic and Social Committee, s.a.). Since 2011, every free trade agreement signed by the EU with a partner country or group of countries has created an EU DAG and a DAG for the counterpart to the agreement (European Economic and Social Committee, s.a.). Thus, up to now, there are 12 EU DAGs corresponding to 12 DAGs, as can be seen in Figure 2 below.

According to the EVFTA, these groups may, on their own initiative, submit views or recommendations. This means that the DAGs, though they may not have an official supervision right, yet they are entitled to observe the implementation of Chapter 13, including renewable-energy-related provisions, putting a certain amount of pressure on the parties. Besides, Art. 13.15(3) of the EVFTA also establishes the Committee on Trade and Sustainable Development, which is entitled to review, if necessary, the implementation of Chapter 13 in general, and the renewable energy commitments in particular. These mechanisms, namely DAGs

Figure 2: Current existing DAGs in agreements signed by the EU with a partner country or group of countries

EU DAG	Total members	EESC	Permanent observers
Canada	23	6	3
Cariforum	13	3	
Central America	16	3	
Columbia Peru Ecuador	20	3	
Georgia	9	3	
Japan	14	3	
Moldova	9	3	
Singapore	14	3	
South Korea	19	3	
UK	30	6	30
Ukraine	14	3	
Vietnam	21	3	

Source: European Economic and Social Committee, s.a.

and the Committee on Trade and Sustainable Development, with the functions mentioned above, such as proposing recommendations and reviewing the implementation, are expected to put a lot of pressure on parties to effectively implement regulations on climate change, including the development of renewable energy. In other words, these mechanisms are predicted to prompt member states to prepare sufficient plans to meet the demands listed for renewable energy development.

Notably, in the event of disagreement on any matter covered under Chapter 13, the parties shall only have recourse to the procedures established under Art. 13.16 and Art. 13.17 of the EVFTA. And Chapter 15 on Dispute Settlement and its Annex 15-C on Mediation Mechanism do not apply to these situations. This means no specific sanctions can be applied, and the EVFTA pursues a separate mechanism to promote the effective implementation of renewable energy commitments. Accordingly, the parties will have recourse to the specific procedures, including government consultations and a panel of experts. In other words, similar to Chapter 7, the violation of the provisions on renewable energy does not basically cause a party to face any serious legal consequences. However, the implementation of renewable energy-related provisions can be guaranteed due to the activeness of member states. The EVFTA, like other free trade agreements, brings a lot of economic and trade benefits to the participating countries, especially enhanced trade and investment opportunities that contribute to the economic growth of developing economies. And these benefits can only be achieved if member states comply with the non-commercial commitments mentioned in

the agreements. As a result, renewable energy development will be focused on due to mutual trade interests and benefits.

4. Renewable Energy Development in the EU: Are its Members Doing Well?

4.1. The EU's Policies and Regulations on Renewable Energy

Europe has an abundance of renewable energy sources, and its member states have, in recent years, become leaders in driving the deployment of renewable technologies. Efforts to increase the sustainability of energy systems in Europe are ongoing, with a legal framework that has been built, is being implemented, and continues to be perfected. The European Commission (EC) has provided a history of renewable energy in the EU through significant events that influenced the development of renewable energy sources in this area (Figure 3).

Figure 3: Timeline for renewable energy in the EU

2023	Provisional agreement to raise 2030 target to at least 42.5%, aiming for 45%
2022	REPowerEU Plan: EC proposal to raise target for 2030 to 45%
2021	Renewable Energy Directive: EC proposal to raise target for 2030 to 40%
2019	EU power production form wind and solar surpass coal for the first time
2018	Revised Renewable Energy Directive: 32% renewables target for 2030
2014	Onshore wind is cheaper than coal, gas, and nuclear energy
2009	Renewable Energy Directive: EU target of 20% renewables by 2020 and national binding targets
2008	Olmedilla Photovaltaic park (Spain) – largest power plant (60MW) in the world – generates enough to power 40 000 homes/year
2003	Directive on biofuels and reneable fuels for transport: national targets for biofuels
2001	Directive on electricity production form renewables: national indicative targets
2000	First large-scale offshore wind farm (Denmark)
1997	Energy for the future: renewable sources of energy: indicative EU target of 12% renewables by 2010
1991	Germany introduces first feed-in-tariff for renewables

Source: European Commission, s.a.

The timeline for renewable energy in the EU's legal framework started with the event in 1991 when Germany introduced the first feed-in tariff for renewables. An Electricity Feed-in Law was introduced to assist producers of electricity from small hydro stations and wind energy installations (European Commission, s.a.). Although it was not successful in the promotion of bioenergy and geothermal energy and was replaced by the Renewable Energy Sources Act in 2000, the Electricity Feed-in Law was considered one of the first support mechanisms for renewable energy (Futurepolicy.org, 2016).

Realizing the importance of renewable energy, the EU started setting up a specific legal framework for this kind of energy. The first step in this direction was the EC's 1997 white paper on renewable sources of energy. Accordingly, Part 1.3.1 sets a target of 12 percent for the contribution of renewable sources of energy to the EU's gross inland energy consumption by 2010. This overall EU target implies that member states had to encourage the increase of renewable energy sources according to their potential, and they should define their own strategy and within it propose their own contribution to the overall 2010 target. In 2001, the EC adopted Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market. The Directive established two targets for the use of renewable energy sources in the energy sector, including that by 2010, 12 percent of gross domestic energy consumption had to be satisfied by renewable energy sources, and for electricity, the goal was set at 22.1 percent. Under the Annex of this Directive, each member state received an indicative target that, combined with that of all the other member states, would have enabled the EU to reach the overall community target (Directive 2001/77/EC, 2001). Although national targets were not binding, member states were expected to provide detailed justification in the event of failure to meet them. With the 2004 enlargement, the 22.1 percent target set initially for electricity was reduced to 21 percent (EUR-Lex, 2011).

In the face of the increasing threat posed by climate change and the urgency to ensure the security of supply, the EC adopted the Renewable Energy Directive 2009/28/EC (RED I). According to Art. 3.1 of RED I, the EU-wide target of renewable energy sources sharing 20 percent of gross final energy consumption by 2020 was set. This target was then allocated to individual member states by means of binding and differentiated national targets. Art. 21.1 of RED I also set a 10 percent target for the share of biofuels in transport gasoline and diesel consumption by 2020. Nine years later, the Renewable Energy Directive 2018/2001 (RED II) was adopted after intense political negotiations, aimed at keeping the EU a global leader in renewables and, more broadly, helping it meet its emissions reduction commitments under the Paris Agreement. RED II, herein Art. 3.1 establishes a new binding renewable energy target for the EU for 2030, moving upwards to 32 percent of final energy consumption instead of the initial 27 percent. Further, Art. 25.1 sets a 14 percent minimum target for renewable energy in the final energy consumption in the transport sector by 2030.

In July 2021, the Commission proposed another revision to accelerate renewable energy adoption in the EU, and to promote achieving the 2030 energy and climate

goals with an increased 40 percent target. After that, this target of increasing to 45 percent by 2030 was proposed in May 2022. The revision of the directive also introduces new measures to complement the already existing building blocks established by the 2009 and 2018 directives to ensure that all potentials for the development of renewable energy are optimally exploited which is a necessary condition to achieve the EU's objective of climate neutrality by 2050 (European Commission, s.a.).

Recently, a provisional political agreement was concluded to raise the share of renewable energy in the EU's overall energy consumption to 42.5 percent by 2030 with an additional 2.5 percent indicative top-up that would allow it to reach 45 percent. Each member state will contribute to this common target (Council of the European Union, 2023).

As can be seen, the EU's policy includes setting time-bound goals for the proportion of renewable energy, which aids member states in pursuing appropriate orientations and strategies to support the EU's achievement of its goal. The directives released by the EU also demonstrate the sectors on which the EU wishes to concentrate in order to improve the efficiency of using renewable energy sources and decrease the usage of conventional energy sources, namely in the transportation sector. The target for the proportion of renewable energy by 2030 has been adjusted to 32 percent, 40 percent, and 45 percent in 2018, 2021, and 2022, respectively. This demonstrates that the strategies the EU is using to promote renewable energy are appropriate. In other words, the EU's policies and orientations have facilitated the member states in achieving their own targets, making progress towards achieving the predetermined targets for renewable energy development in the region.

To sum up, the promotion of renewable energy sources is a long-term strategy of the EU, and the EU has adopted a series of specific targets over the years to foster it. Achieving this goal requires the efforts of all the member states with policies and laws appropriate to their circumstances.

4.2. Some Leading Countries' Legal Frameworks in Promoting Renewable Energy

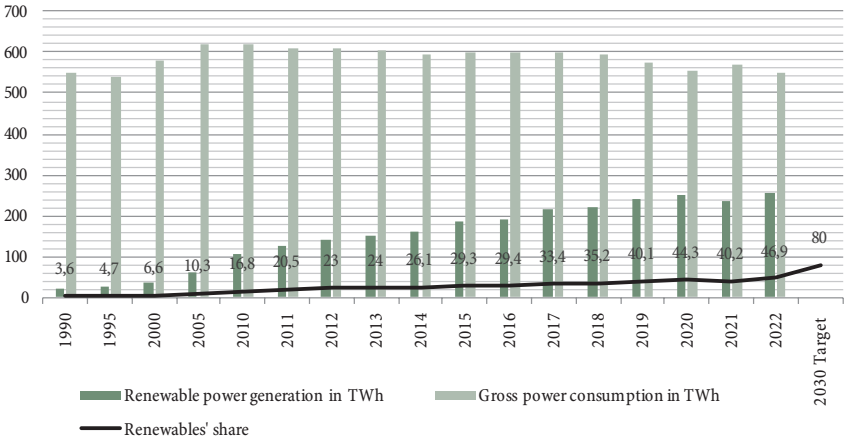
4.2.1. Germany

Germany is recorded as a world leader in its level of renewable energy deployment. Thanks to a long-term renewable energy policy that dates back to the 1970s (International Renewable Energy Agency, 2015) and the wave of protests against nuclear power in the 1980s (Appunn, 2021), this country is spearheading a transition to renewable energy. Up until now, in the energy transition with a focus on renewable energy, Germany has issued many regulations and policies to regulate and promote the development of this type of energy.

In terms of laws and regulations, some notable documents could be listed, including the Renewable Energy Sources Act (EEG), the Power Grid Expansion Act (EnLAG), the Grid Expansion Acceleration Act (NABEG), the Offshore Wind Energy Act (WindSeeG), and the Law on the reduction and termination of coal-fired power generation and the amendment of further laws (Kohleausstiegsgesetz).

Germany sets clear goals with a roadmap for each period and specifies any factors in the development of renewable energy by promulgating and amending laws mentioned above. For instance, EEG 2014, as well as EEG 2017 and 2021 stipulate that the share of electricity produced from renewable energy sources in gross electricity consumption shall increase to 40–45 percent by 2025, 55–60 percent by 2035, and at least 80 percent by 2050. However, the Easter Package, which was just released on April 7, 2022, altered the aim for the share of renewables in power consumption, requiring at least 80 percent to be reached by 2030 (Figure 4). This change is completely reasonable, and the new goal is likely to be met when, as can be seen in Figure 4, this share is 46.9 percent in 2022, rather than 40–45 percent by 2025 as stated in EEG 2021. Especially, EEG 2023 states that the use of renewable energies is of overriding public interest. This is to say that renewable energy will be given priority over other concerns of the German government until greenhouse gas neutrality is achieved.

Figure 4: Renewables' share in gross power consumption in Germany over the period 1990–2022

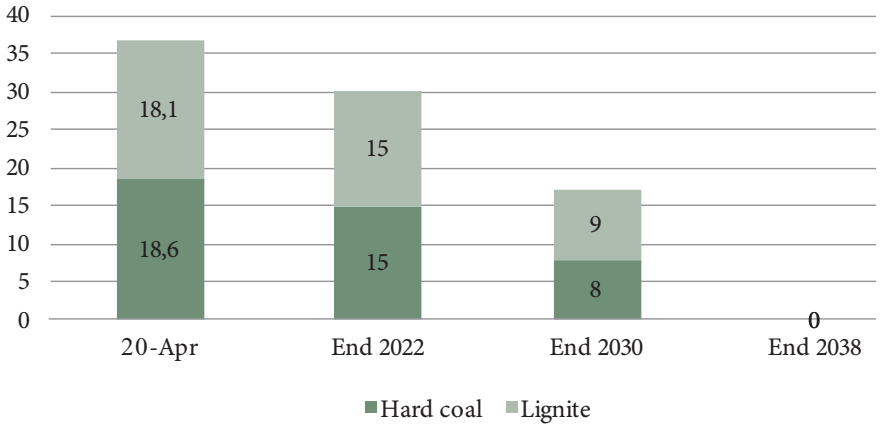


Source: Appunn, Haas, and Wettengel, 2023.

According to the Kohleausstiegsgesetz, coal-fired power plants can only produce 30 gigawatts (GW) of electricity by 2022, 17 GW by 2030, and 0 GW at the latest by 2038 (Figure 5). In other words, Germany will completely stop using coal power by 2038. This is a crucial objective to increase the amount of electricity generated from renewable energy sources, focusing on solar and wind power. To be more specific, the government wants to increase installed solar capacity worldwide from 60 GW in 2021 to 215 GW by 2030 which requires the annual deployment of 22 GW of new capacity (Ivanova, 2022). This goal represents Germany's effort to wean their country off of Russian fossil fuels (Ivanova, 2022), and according to Germany, it has been accomplished (TASS, 2022). In the matter of wind power, Germany will have approximately 115 GW of wind turbines by 2030 if onshore wind development reaches 10 GW per year (Appunn and Wettengel, 2022). Each state in Germany must reserve a minimum amount of land for the construction of wind turbines to enable the expansion of new capacity, resulting in a total of 2 percent of Germany's land area being made available for wind energy, more than twice the area authorized (Ivanova, 2022). By 2030 and 2040 the installed capacity of offshore wind energy facilities will reach 20 GW and 40 GW, respectively, under Wind SeeG (Climate Change Laws of the World, 2017). However, these goals are adjusted based on the Kohleausstiegsgesetz, namely 30 GW by 2030, 40 GW by 2035, and at least 70 GW by 2045 (Ivanova, 2022). Furthermore, EnLAG and NABEG serve as the foundation for the effective, transparent, and ecological

expansion of the transmission grid concerning interstate and international very-high-voltage lines.

Figure 5: Shutdown plan of German coal-fired power plants until 2038



Source: Göß, 2020.

Germany has demonstrated a clear emphasis on the development of renewable energy through the establishment of specific objectives and policies that have been formalized into legal regulations in various laws, all in pursuit of a green energy economy. The ongoing revisions to EEG have demonstrated Germany's efforts in the energy transition. The EEG 2014 witnessed a transition from the fixed feed-in tariff system to an auction mechanism for determining the support levels allocated to renewable energy projects. In addition to the auction mechanism, the EEG 2014 also implemented a surcharge framework aimed at financing support payments for renewable energy projects. EEG 2017 was enacted to facilitate grid connectivity and priority coordination, while EEG 2021 has eliminated the surcharge mechanism, resulting in cost savings for German citizens in their annual expenditure. Based on statistical data, it can be observed that EEG 2017 underwent 13 amendments from its enactment in 2017 up until the implementation of EEG 2021 (CMS, 2020). The Easter Package and the Kohleausstiegsgesetz exemplified the adaptability and timeliness of the German legal framework concerning renewable energy, thereby contributing to Germany's progress towards achieving carbon neutrality by 2050.

4.2.2. Spain

Spain is one of the bright spots in renewable energy. According to a report by the International Renewable Energy Agency, in 2021 Spain ranked fifth in the world and second in the EU, after Germany, in terms of the total capacity of renewable energy. This country has an advantage in energy supply as it has been promoting many other clean energy sources, including wind power and solar cells.

Spain has issued a diverse range of legal instruments, such as laws, royal decree-laws, royal decrees, orders, and resolutions, in relation to renewable energy. The variety in the types of legal documents pertaining to renewable energy in Spain is indicative of the Spanish government's keen focus and investment in this domain. The present text highlights several legal documents that have significantly impacted the progress of renewable energy in Spain. These documents include Law 24/2013 on the electric sector, along with two associated documents, namely Royal Decree-law 15/2018 on urgent measures for energy transition and consumer protection (Royal Decree-law 15/2018) and Royal Decree 244/2019 regulating the administrative, technical, and economic conditions of the self-consumption of electric energy (Royal Decree 244/2019); Royal Decree-law 23/2020 which approves measures in the field of energy and in other areas for economic recovery (Royal Decree-law 23/2020); Law 7/2021 on climate change and energy transition (Law 7/2021); and Royal Decree-law 6/2022 adopting urgent measures as part of the National Plan in response to the economic and social consequences of the war in Ukraine (Royal Decree-law 6/2022).

In Spain, a price regulation system was primarily used to boost the generation of electricity from renewable sources (Jimeno, M., 2019). Law 24/2013, which replaced Law 54/1997 as the sector's governing law, eventually phased out this system. The primary motivation behind Law 24/2013 was to develop a new support program in order to address the unsustainable tariff deficit in the electricity sector (Climate Change Laws of the World, 2013). As a result, traditional energy sources will be pushed to compete with renewable energy sources on the open market. Additionally, the program will help renewable energy sources recoup expenses that they would not have been able to by selling electricity on the open market. Renewable energy sources are given priority for connection and dispatch, particularly with regard to grid access and grid use, provided that they do not constitute a danger to the grid itself. It is clear that whether or not the new energy source is adopted depends on how well-guaranteed its capacity of supply and its quality of transmission are. And because of this, the Spanish government accords projects

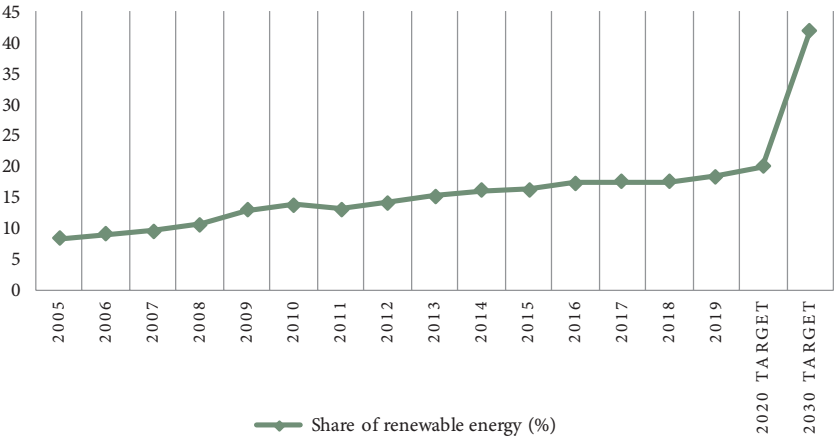
involving renewable energy a special priority in terms of licensing and priority coordination, serving as the foundational basis for the market entry of this newly developed energy source. This demonstrated that the development of renewable energy sources has been encouraging in Spain.

In addition to the introduction of renewable energy sources into the market, there were several noteworthy financial incentives implemented to promote the adoption of renewable energy and energy-saving technologies by both consumers and enterprises. Royal Decree-law 15/2018 (Climate Change Laws of the World, 2018) introduced some measures, such as tax exemptions for energy producers incorporated into the electricity system for six months, energy products used for electricity production in power stations or combined heat and power stations, and self-consumed energy of renewable origin, co-generation, or waste. Furthermore, the Spanish government also promulgated Royal Decree 244/2019 (Climate Change Laws of the World, 2019) to promote the use of energy for self-consumption, with a particular emphasis on renewable energy. Accordingly, collective self-consumption among a group of individuals beyond individual ownership is permitted, and the administrative processes for small-scale producers are simplified. The Spanish government acknowledges that the popularity of renewable energy is contingent upon the dissemination of knowledge and the prioritization of its utilization among the population. Hence, apart from encouraging production, priority is also given to the promotion of utilization. The aforementioned policies have the objective of maintaining equilibrium between the supply and demand of the national energy market, enhancing the consciousness of energy consumers in selecting a sustainable energy source, and aiding in the preservation of energy security and quantity for future generations.

The year 2020 witnessed a significant disruption in the global economy due to the outbreak of the COVID-19 pandemic which also had a profound effect on the economy of Spain and other nations. The Royal Decree-Law 23/2020 was enacted to support the energy transition in the aftermath of COVID-19. This decree-law has set a number of short- and medium-term targets related to the proportion of renewable energy in each period, including that renewable energy production must increase by 2.200 ktep in the period 2020–2022, and by about 3.300 ktep in the period 2022–2025; renewable energy sources should account for 24 percent of the energy mix by 2022, 30 percent by 2025, and 42 percent of the energy mix by 2030 (Figure 6). Furthermore, it covered several significant aspects, including provisions for the development and enhancement of renewable energy. These provisions outline the criteria for managing access to and connection with

the grid which are based on the progress and technical success of projects. To meet this, the governance requirements for licensed and implemented projects are detailed and specific. A new stable and predictable auction mechanism for renewable resources was also introduced in this decree-law, in which the bidding variable is the energy subsidy price, for a cost-effective orientation. Notably, the Royal Decree-law advocates for the promotion of fresh business models within the ambit of energy policy. To encourage new business models, this decree-law has overcome the lack of governance when stipulating methods to build a part of the power system, including storing, combining, synthesizing, and forming the renewable energy community. In addition, the Government of Spain has prescribed a number of additional measures to encourage the development of renewable energy, such as allowing lower-cost transitions for some cases of mobile grid facilities without applying for a license and approving the establishment of electric vehicle charging stations with a capacity of over 250 kW for public interest.

Figure 6: Share of renewable energy of total energy consumption in Spain

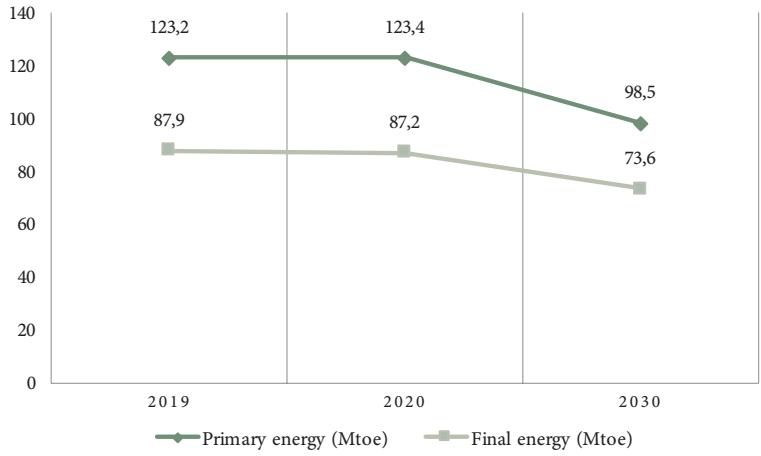


Source: European Parliament, 2021, p. 5.

The first step towards achieving Spain's commitment to climate neutrality at the global and European levels is the passage of Law 7/2021 on May 20, 2021 (Osborne Clarke, 2021). Accordingly, this law was enacted to ensure that Spain complies with the obligations set out in the Paris Agreement on climate change, and to promote Spain's decarbonizing economy by encouraging the application of a circular model, rational use of resources, adaptation to the impacts of climate change, and sustainable development. To achieve these goals, a number of medium- and

long-term targets have been set, including reducing emissions by at least 55 percent by 2030, improving energy efficiency to 39.5 percent compared to the basic level in community regulations which translates into the levels of energy consumption shown in Figure 7, and increasing the share of renewable energy to 74 percent by 2050. In particular, this law abolished new licensing for oil and gas exploration and production activities in Spain, showing the consistency in the policy of promoting and encouraging the development of renewable energy that Spain is pursuing. Similar to Germany, Spain pursues the goal of becoming carbon neutral, or 100 percent renewable energy powered, by 2050. To achieve this goal, fossil fuels, including oil and gas, should be replaced by renewable energies, and the Spanish government demonstrated its determination with the above policy.

Figure 7: Energy efficiency: primary and final energy consumption (Mtoe)



Source: European Parliament, 2021, p. 5.

Europe has historically been dependent on energy imports from Russia, particularly in the form of natural gas. However, the Russo-Ukrainian war has highlighted the vulnerabilities and risks associated with this dependency. As a result, many European countries, including Spain, have been accelerating their efforts to transition to renewable and sustainable energy sources in order to reduce their carbon footprint and enhance energy security. According to Royal Decree-Law 6/2022, some measures were applied, including revised remuneration parameters in the specific remuneration system for electricity generation facilities using renewable energy sources, co-generation, and waste, applying in 2022, and the removal of

the value of adjustment due to deviations from market prices in 2023. By revising remuneration parameters, Spain can provide clearer and more attractive financial incentives for renewable energy projects. This can encourage greater investment in renewable energy infrastructure and technologies, stimulating the growth of the sector. Meanwhile, the move towards market-based pricing for renewable energy promotes efficiency and cost-effectiveness. It allows renewable energy producers to respond to market signals and compete on a level playing field, potentially driving down costs and improving the competitiveness of renewable energy sources. In particular, this Royal Decree-law has introduced measures to accelerate the performance of renewable energy projects to quickly achieve a decarbonizing economy and reduce reliance on traditional energy sources, such as environmental impact assessments, simplifying the approval procedure for renewable energy projects, and constructing floating solar photovoltaic plants (Garrigues, 2022).

5. Renewable Energy Development under Vietnamese Law

5.1. Common Strategies

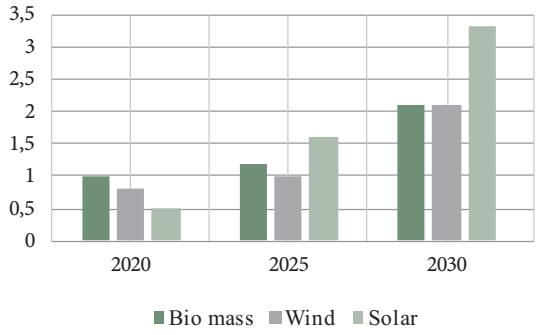
The Vietnamese government clearly defines the importance of renewable energy in sustainable development, and the development of renewable energy is an inevitable trend as well as an urgent need that Vietnam shall take into account. In fact, Vietnam affirms its stance on the development of renewable energy through policies, laws, and regulations.

In the field of renewable energy, Vietnam has shown its interest in this field by issuing short-, medium-, and long-term strategies and plans. Notably, in 2007, Vietnam promulgated Vietnam's National Energy Development Strategy up to 2020 with a vision to 2050 in Decision No. 1855/QD-TTg, stipulating general principal issues such as perspectives, goals, and development orientation. In 2011, Decision No. 1208/QD-TTg, dated July 21, 2011, on the National Master Plan for Power Development in the 2011–2020 period, with considerations to 2030, was issued by the Prime Minister. This plan, also known as the Power Master Plan VII, set the target of developing renewable energy sources for electricity production, increasing the proportion of electricity produced from these sources from 3.5 percent of total electricity produced in 2010 to 4.5 percent in 2020 and 6.0 percent in 2030. This plan was adjusted and promulgated by the Prime Minister according to Decision No. 428/QD-TTg dated March 18, 2016. Accordingly, Vietnam continued to increase the proportion of electricity produced from renewable energy sources,

excluding large and medium-sized hydroelectricity and storage hydropower, to reach about 7 percent by 2020 and over 10 percent by 2030 (Figure 8). To further promote the development of this type of energy, Decision No. 2608/QD-TTg dated November 25, 2015, approved Vietnam's renewable energy development strategy up to 2030 with an outlook to 2050. This strategy provided views and strategies for renewable energy development, especially various preferential policies such as tax and land incentives or financial support for research related to renewable energy.

Figure 8: Renewables in Vietnam's energy sector

Renewable energy (% electricity production)	2020	2025	2030
	6.5%	6.9%	10.7%



Source: British Business Group Vietnam, s.a.

From the perspective of laws and regulations, the Electricity Law stipulates that the elaboration of electricity development planning must be consistent with the development orientation of primary energy sources for power generation, including new energy sources and renewable energy. The Law on Economical and Efficient Use of Energy stipulates that those strategies, plans, and programs on energy use must raise the proportion of renewable energy use. The Law on Environmental Protection stipulates that renewable energy development is one of the state's policies on environmental protection.

It could be seen that the Vietnamese Government clearly defines the importance of renewable energy in sustainable development and the development of renewable energy is an inevitable trend as well as an urgent need that Vietnam shall take into account. Thus, Vietnam affirms its stance on the development of renewable energy through policies, laws, and regulations.

5.2. Some Specific Prominent Areas

Not only showing its interest in general strategies, but Vietnam also issued regulations in a number of specific and prominent areas.

Regarding the development of solar and wind power, the Government of Vietnam issued a mechanism to encourage the development of these types of energy in some legal documents, such as Decision No.11/2017/QD-TTg dated April 11, 2017, on the support mechanisms for the development of solar power projects in Vietnam, Decision No.13/2020/QD-TTg dated April 6, 2020, on mechanisms to promote the development of solar power projects in Vietnam, Decision No.37/2011/QD-TTg dated June 29, 2011, on the mechanism supporting the development of wind power project in Vietnam, Decision No.39/2018/QD-TTg dated September 10, 2018, amending and supplementing a number of articles of Decision No.37/2011/QD-TTg. These policies created a preferential mechanism to attract large investments from all economic sectors, especially the private sector involved in the development of solar and wind energy (Vy, 2021). For instance, as you can see in Figure 9, during the time frame of 2010–2019, in the year 2010, a solitary non-state enterprise was involved in the investment in wind and solar power. Nevertheless, there was a substantial rise in the number of non-state enterprises operating in these sectors, reaching 379 in 2019. The proliferation of non-state enterprises engaged in energy investment has led to a significant shift in the enterprise structure, with their share of total investment enterprises rising from 59 percent to 94.8 percent, thereby dominating the sector.

Figure 9: Quantity and proportion in the field of energy in the period 2010–2019

Year	Total		Renewable energy (Wind, solar)	
	State enterprises	Non-state enterprises	State enterprises	Non-state enterprises
I	Quantity (number of enterprises)			
2010	48	69	-	1
2015	57	186	-	8
2019	43	777	6	379
II	Proportion (%)			
2010	41.0	59.0	0.0	100.0
2015	23.5	76.5	0.0	100.0
2019	5.2	94.8	1.6	98.4

Source: Vy, 2021.

In particular, the total investment capital of non-state enterprises also increased steadily in the past period, especially investment in solar power and wind power, with strong growth in 2019 thanks to the feed-in tariff pricing policy. The total investment in renewable energy in 2019 amounted to 4,490 billion Vietnamese dong (€179 million), representing a 27-fold increase compared to the 166 billion Vietnamese dong (€6.6 million) invested in 2010, as can be observed in Figure 10.

Figure 10: Total investment and proportion of enterprises in the field of energy in the period 2010–2019

Year	Total		Renewable energy (Wind, solar)	
	State enterprises	Non-state enterprises	State enterprises	Non-state enterprises
I	Total investment (billion dong)			
2010	29,527	2,332	-	166
2015	42,828	3,738	-	83
2019	62,273	17,826	214	4,490
II	Proportion (%)			
2010	92.7	7.3	0.0	100.0
2015	92.0	8.0	0.0	100.0
2019	77.7	22.3	4.6	95.4

Source: Vy, 2021.

This preferential mechanism involves the application of the feed-in tariff price to projects whose commercial operation date meets a certain time. For instance, according to Decision No.13/2020/QD-TTg, the feed-in-tariff price was only applicable to projects whose commercial operation date was between July 1, 2019, and December 31, 2020. The feed-in tariff price mechanism has been applied in many countries around the world and has proven to be one of the most effective policy tools, helping to overcome cost barriers to the dissemination and commercialization of renewable energy (Pham, Nguyen, T-T., Nguyen T-C., 2022). However, the implementation and application of this policy shows that there are still many problems to be solved. Accordingly, the feed-in tariff price is only applied within two years for solar energy projects under Decision No.13/2020/QD-TTg and three years for wind energy projects under Decision No.39/2018/QD-TTg. These durations are too short for projects that need construction and operation time such as wind and solar power, especially when the feed-in tariff pricing policy took place during the COVID-19 epidemic period. For projects that had signed power purchase and sale contracts with EVN before January 1, 2021 (for solar power) and before November 1, 2021 (for wind power), but did not meet the conditions to be eligible for the application of the feed-in tariff price, the electricity generation

price range would be created under Circular 15/2022/TT-BCT dated October 3, 2022, announcing the electricity generation price range for transitional wind and solar power projects. This can be considered the beginning of solving the bottlenecks of more than one year of transitional solar and wind power projects (Editorial Board of Vietnam Energy Journal, 2022).

Furthermore, within the realm of power transmission grid expansion, the Electricity Law has granted permission for private sector involvement in power transmission grid investment. To date, there exists a lack of comprehensive guidance, particularly with regard to transmission pricing, investment cost management, and state oversight in ensuring the security of the transmission grid in instances where private sector investment is involved (An, 2022). Consequently, power generation entities have been compelled to curtail their production of sustainable energy due to constraints associated with the transmission network. Accordingly, although clean energy is urgently needed, Vietnam still has to plan to cut around 1.3 billion kWh of renewable energy in 2021 because of the lack of necessary transmission capacity (Johnson, Chau and Aramayo, 2021). In the previous year, there was a notable upsurge in the advancement of renewable energy, particularly in the rooftop segment. This resulted in a 66 percent increase in capacity, reaching a peak of 10,000 megawatts between the months of June and December. An excess of solar energy production has resulted in an oversupply, leading to overloads in the central provinces of Ninh Thuan and Binh Thuan. As a result, Vietnam Electricity was compelled to reduce solar output by 365 million kWh in 2020 (Minh, 2021).

In general, it can be seen that renewable energy has not been regulated in a specialized legal document. Additionally, the policy to encourage renewable energy development in Vietnam is still not long-term and stable which is reflected in the short duration of the feed-in tariff price application.

6. Renewable energy development in Vietnam: What could be learnt from Germany and Spain?

Most importantly, it is imperative for Vietnam to establish a comprehensive regulatory framework for renewable energy. In order to attain this objective, it is imperative to establish a hierarchy of preference for each category of sustainable energy source and to guarantee the efficient allocation of resources for each energy form in alignment with the socio-economic development circumstances of

Vietnam. In addition, it is imperative to disseminate legal instruments that regulate renewable energy undertakings at an elevated echelon, such as the Renewable Energy Law. The objective of this law is to establish a framework that guarantees the durability and sustainability of the mechanisms and policies that facilitate the promotion of renewable energy. This will engender a sense of confidence among investors and credit institutions, thereby facilitating the process of investing in and lending to renewable energy projects.

Furthermore, Vietnam needs to promulgate policies and legal documents proactively and promptly in line with the actual context. As previously stated, Germany revised a number of legal provisions on renewable energy and increased the installed solar capacity to achieve the goal of ridding their dependence on Russian gas supplies amid Russia-Ukraine tensions. Similarly, Spain also issued Royal Decree-Law 6/2022 adopting urgent measures as part of the National Plan in response to the economic and social consequences of the war in Ukraine, and Law 7/2021 on climate change and energy transition to ensure compliance with the obligations set out in the Paris Agreement, of which Spain has been a member since 2016. Meanwhile, in Vietnam, once the feed-in tariff policy to promote the development of solar and wind power expires, documents guiding new mechanisms to replace this policy have not yet been issued.

No less important, the development of power transmission network and infrastructure should be promoted to serve the activities of production and distribution of electricity generated from renewable energy. As previously noted, Vietnam has made significant strides in its capacity to produce electricity from renewable sources. However, the existing transmission infrastructure has not kept up the pace with this progress, resulting in a decrease in the overall output of renewable energy-generated electricity. This has a noteworthy influence on the prospective growth of sustainable energy.
Afterwards, it is imperative for Vietnam to establish a rationalized policy regarding electricity pricing and other prioritized policies to sustain investments in renewable energy. Developing a feed-in tariff pricing structure for grid-connected renewable energy and prioritizing renewable energy projects for connection to the national electricity system are imperative measures. Simultaneously, it is imperative to mandate that power entities assume accountability for procuring the total quantity of electricity generated from sustainable sources via a standard electricity procurement contract. The provision of incentives instills a sense of security among businesses engaged in the investment and production of renewable energy sources, thereby encouraging their continued participation in these activities.

7. Concluding Remarks

Developing renewable energy will have positive effects on the economy while minimizing harmful consequences for the environment. This is even more meaningful in the context that countries around the world have been tending to step up in signing and joining of free trade agreements regulating both commercial and non-commercial issues, including the fight against climate change. Vietnam is not outside this trend and has proven to be an active participant in these free trade agreements, notably the EVFTA. This agreement was signed between Vietnam and the EU.

The EU is an active region in the development of renewable energy to achieve its commitment to a clean energy transition. To deliver on this commitment, the EU has set binding climate and energy targets. To ensure that the EU targets are met, EU legislation requires each member state to draw up a 10-year National Energy and Climate Plan, setting out how to reach its national targets, including a binding target for reducing greenhouse gas emissions. As bright spots in the development of the energy transition, Germany and Spain are doing well in the development of renewable energy, contributing to shaping the EU's green recovery.

Vietnam is one of the Southeast Asian countries with a fast gross domestic product (GDP) growth rate. In the current context of growing industrialization and economic modernization, energy demand is predicted to increase. Following the global trend of developing renewable energy, Vietnam has carried out a gradual shift towards renewable energy alongside the conventional power generation industry due to the great potential for renewable energy. Despite investment in this sector, the current results show that it is not commensurate with the potential that Vietnam currently has. It can be seen that Vietnam is still facing a lack of policies and mechanisms to encourage the development and use of renewable energy. Consequently, to encourage the development of renewable energy and build a green and environmentally friendly economy, Vietnam needs to establish a comprehensive regulatory framework for renewable energy, promulgate policies and legal documents proactively and promptly in line with the actual context, promote the development of a power transmission network and infrastructure to serve the activities of production and distribution of electricity generated from renewable energy, and establish a rationalized policy regarding electricity pricing and other prioritized policies to sustain investments in renewable energy.

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Chinese Pursuit of Energy Security via Partnerships' Development within the SCO Mechanism

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Abstract: This paper aims to examine the impact of the Shanghai Cooperation Organization (SCO) on China's pursuit of energy security. As the first multilateral cooperation mechanism is initiated by China, the SCO is guided by Chinese values and emphasizes the development of partnerships instead of alliances. The research question focuses on whether the SCO and its Energy Club operate as a multilateral mechanism when it comes to energy cooperation or if bilateral arrangements are needed for China to secure its energy needs.

The paper will explore the energy potential offered by the SCO, particularly since Iran became a full member state and Qatar and Saudi Arabia became dialogue partners. It will also examine to what extent the SCO helps China in making "Petro Yuan" and how it impacts China's energy security from both continental and maritime aspects. The authors will use descriptive statistics and content qualitative analysis to evaluate the results within the SCO regarding energy security, as well as a literature review in the field of energy security and diplomacy, with a specific focus on bi-multilateralism.

The paper's contributions will include recommendations for a better understanding of energy security issues within the scope of Chinese instigated mechanisms of cooperation and diversification of sources and cooperation that brings new geopolitical and geoeconomic "question marks".

Keywords: green hydrogen, SCO, SCO Region, security cosmopolitanism, diplomatization, China, and bi-multilateralism.

JEL: F51, F55, N75, P18, Q42

1. Introduction and Theories

In academia, there are pressing questions concerning diplomacy and security, such as whether they are still sustainable (Stefanovic-Stambuk, 2010; Stefanovic-Stambuk and Popovic, 2022). China's rise has demonstrated that diplomacy and security are still viable and closely intertwined. This paper will examine China's strategies in securing energy security via the SCO Energy Club, theorizing the type of sustainable diplomacy for China in this regard. Furthermore, this paper will answer to what extent the SCO Energy Club promotes "Petro Yuan" and how it impacts China's both maritime and continental strategies in securing energy security.

This paper combines diplomacy and security for two reasons, the first being that energy security is a part of national security, while the second is that China believes security issues should be diplomatized, not securitized (Neumann, 2020; Stefanovic-Stambuk and Popovic, 2022). China views both diplomacy and security as relational practices (Qin, 2020) and does not follow a substantialist, i.e., atomistic perspective, implying that the world consists of relations which are always changing (Xing, 2015). China's leaders understand the current moment as unprecedented changes (MFA PRC, 2022), in which China shows strategic patience (Zhongping and Huang, 2014) in threading new relations for directing these changes. As one of the urgent needs which is recognized in achieving this goal is to strengthen the Party's centralized, unified leadership over foreign affairs work (Xi, 2018). This official action reflects both Chinese perception of the unstable foreign environment and its negative view of it, which impacts domestic politics. Institutions should be centralized, and wider public inclusion in politics should be limited. Making diplomatic apparatus centralized which follows clearly defined goals and plans, China's leaders believe that it corresponds not only to major-country diplomacy with Chinese characteristics, but also to promoting innovations in diplomatic theories and practices (Xi, 2018), such as strategic partnerships. Intentional threading of different types of strategic partnerships which implies different levels of expected reciprocity and closeness is mirroring China's understanding on the nature, feature, and manner for resolving security issues in regard to both domestic and global security. This was particularly notable when China on February 21, 2023 released *The Global Security Initiative Concept Paper* (MFA PRC, 2023). This Initiative as a tool in promoting security for every state, human and non-human being worldwide, was introduced by Xi Jinping in 2022 when he delivered a keynote speech at the opening of the BOAO Forum in 2022 (Xi, 2022). In this Concept Paper we can read that the

issue of security bears on the well-being of people of all countries, the lofty cause of world peace and development, and the future of humanity, where security is more interconnected, transnational, and diverse (MFA PRC, 2023). This kind of opinion on security is in accordance with the theoretical approach known as security cosmopolitanism offered by Anthony Burke. This scholar (2013, p. 18) stated that there can be no successful immunization of the national body against insecurities that come from outside. Since one state cannot be immunized from external threats, insecurity, thus, stems and arises in a borderless way from the very histories, choices, powers, and systems of modernity. This generates both a new analytical model for global security and a different—relational, networked, and future oriented—ethic of responsibility (Burke, 2013, p. 13). Henceforth, for this theoretical approach, security relies on normative principles of a relational ontological matrix (Burke, 2015, p. 198). Security cosmopolitanism in its theoretical structure requires constant improving of security architecture which implies that it is future-oriented. This futuring is similar to Iris Marion Young's global political theory (2011, p. 92) in which she claims that the meaning of political responsibility is forward-looking. One has the responsibility always now, in relation to current events and their future consequences. This futuring is similar to Chinese understanding of responsibility of each country for bettering the world order and overcoming unilateralism, power politics, and dominance. In regard to the future-oriented behavior, Xi Jinping (2022) stated that problems are not to be afraid of, as it is one problem after another that has driven the progress of human society. No difficulties could ever stop the wheel of history (Stefanovic-Stambuk and Popovic, 2022). In terms of energy security, this means sustainability. Sustainability is a normative concept that refers to a state of affairs whereby the needs of today are not fulfilled at the cost of the needs of tomorrow (Proedrou, 2018, p. 113).

In securing energy security, China advocates that countries should respect the principles of common, comprehensive, cooperative, and sustainable security. These adjectives on security are incorporated in China's official discourse since the introduction of the New Security Concept (Popovic, 2020). From the industrial revolution onwards, energy together with technology became the key factor of production (Mitrovic, 2012, p. 281). Casting light from that theoretical view, the concept of energy security has been the dominant prism through which all risks, threats, gains, and advances have been incorporated into stakeholders' strategies (Proedrou, 2012, p. 4). It became particularly important after two oil shocks. The International Energy Agency (IEA 2011, p. 9) defines energy security as an uninterrupted physical availability at a price which is affordable, while respecting

environmental concerns. A similar definition on energy security was provided by Filippos Proedrou (2012, p. 3) advocating that energy security is a situation whereby states face no energy shortages and meet their energy needs at no excessive cost and without further deteriorating the state of the environment. These offered definitions revealed that the main features of energy security are supply, affordability, acceptability, and sustainability (Proedrou, 2018). We can also add stable relations with energy exporting states, resilience to geopolitical turmoil, smooth flow of supplies, that is, secure routes—pipelines and sea lanes of communications and energy resources.

Furthermore, in the theoretical aspect of this paper, the controversial and thought-provoking diplomatic concept of bi-multilateralism is included. According to Michael Smith (2003), the occasions for bi-multilateral negotiations are defined by the coexistence of occasions both at the bilateral and at the multilateral level. Occasions also raise major issue of motivation: the coincidence or the close relationship between bilateral negotiations and multilateral events puts a new twist on the formation of preferences and priorities. In terms of agendas, the specific properties of bi-multilateral negotiations again create potential difficulties: how do the results of bilateral negotiations find expressions in multilateral agendas, and *vice versa*. This is crucially important for the SCO Energy Club in finding solutions as to how to create co-constitutive and context of co-dependency between bilateral energy deals and the SCO multilateral rules. More specific, how to transform different bilateral energy deals into clear SCO energy rules when there is no will to define an SCO common energy approach. It can be seen from this discussion of the analytical issues that one of the key problems in bi-multilateral negotiations is what might be termed 'co-dependency' of occasions, contexts, participants, agendas, and outcomes. This is not simply a contingency or an accident, it is an integral part of the negotiation process (Smith, 2003). A similar and more simplified understanding on bi-multilateralism was offered by Sonja Eremic (2018) who stated that bi-multilateralism is a composite of both bilateral and multilateral negotiations. The reasons for co-constitutive negotiations are offered by Adam Watson (1984), advocating that independent states deal bilaterally with each other and meet together in multilateral organizations not only because they have interests in common, but also because they have interests which conflict. With an aim to transform a possible conflict in the matter of diplomacy and not a weaponry race, China's diplomatic thinking in the new era manifests in a profound way the values of connection, inclusiveness, and harmoniousness (Xing, 2015).

Before moving to the next part of the paper, we consider it important here to briefly explain the SCO. The SCO was founded in 2001 on China's initiative which was supported by other countries. One of its sub-mechanisms for promoting mutual cooperation is the SCO Energy Club. Currently, SCO member states include China, Russia, Kazakhstan, Tajikistan, Uzbekistan, Kyrgyzstan, India, Pakistan, and Iran, while observer states are Afghanistan, Belorussia, and Mongolia, and dialogue partners are Armenia, Azerbaijan, Cambodia, Egypt, Nepal, Qatar, Saudi Arabia, Sri Lanka, Turkey. When we look to the geographic coverage of the SCO, we notice that it embraces the world's biggest energy producers and consumers. Their decisions directly influence not only the structure of relations of global energy governance and its course, but also energy prices on the global market. Having this in mind, it is more than important to tackle the potential of the SCO Energy Club in becoming one of the most active actors in global energy governance, for example, maintaining and changing global production and supply chains, mirroring developing countries' power, and reorganizing energy pricing to name but a few.

2.Bamboozling China's Energy Security

China's reforms and opening policy, which was initiated in 1978, pushed China into a puzzling, dynamic, and never-ending game of securing energy security. China became a country whose development depended on imported energy from overseas. This circumstance pressed the leaders of the Chinese Communist Party (CCP) to take a geopolitical look at the international order and pursue innovative and creative diplomatic strategies for securing energy security. On the one hand, China has to overcome the issue of constantly increasing energy shortage, which, on the other hand, expresses vibrant development of China's economy. In 1993, China became a net oil importer and, in 2013, became the world's biggest importer of oil, meaning that China is not, in terms of energy security, a self-reliant country. Thus, it is becoming even more urgent to understand modern China's definition and communication of its identity in international energy relations in making its energy choices (Kuteleva, 2022, p. 27). So far, China's side did not securitize energy security; rather, it diplomatized it, that is, made it a matter of diplomacy (Stefanovic-Stambuk and Popovic, 2022).

When it comes directly to energy imports of China, for the purpose of this paper, we are going to tackle only China's cooperation with some and not all states, which, in different manners, on different levels, and from different views and

expectations, are cooperating with the SCO, that is, are included in the SCO network of cooperation. When it comes to the Chinese cooperation with Saudi Arabia, it attracted a lot of attention from the global political, business, and academic public. Saudi Arabia is a dialogue partner to the SCO and a founding state of the Organization of Petroleum Exporting Countries (OPEC). Saudi Arabia is the destination from which China imports the largest amount of petroleum. During 2022, Saudi Arabia shipped a total of 87.49 million tons of crude petroleum to China, equivalent to 1.75 million barrels per day (bpd) (Reuters, 2023). The two sides attracted even more attention and alarmed the international society, particularly the USA, when they signed the deal to trade in yuan instead of dollars. Bearing in mind that China is buying more than 25 percent of Saudi Arabia's oil export, their pricing in yuan will not only accelerate the internationalization of yuan, but it will also have global consequences since the USA exerted its dominance in the Middle East by pricing oil from this part of the world in dollars. The dollar is the strongest American geopolitical weapon. The Saudis are also considering including yuan-denominated futures contracts, known as the petro yuan, in the pricing model of the Saudi Arabian Oil Co., known as Aramco (Summer and Kalin, 2022). Pricing in yuan dates back to 2018, thus, it is not a novelty introduced by Sino-Saudi cooperation. However, the novelty is China's far greater and active diplomatic and economic involvement in the region, which was so far exclusively reserved for and dominated by the USA and its strategies of a weaponry race. On the other hand, we have to carefully follow this cooperation since the USA will not passively let China dictate the rules of the energy game in the Middle East and additionally increase its diplomatic power.

Washington was also shaken when China facilitated the re-establishment of diplomatic relations between Saudi Arabia and Iran, which is a significant development in the Middle Eastern energy game. China played a mediating role and facilitated a Joint Trilateral Statement between China, Saudi Arabia and Iran. The statement included an agreement between Iran and Saudi Arabia to re-establish diplomatic relations and to resolve their bilateral issues through diplomatic means. Iran and Saudi Arabia expressed their gratitude to China for its efforts in organizing this communication and its commitment to providing regional peace and security (MFA PRC, 2023a). The establishment of diplomatic relations between Saudi Arabia and Iran, two significant players in the Middle East and founders of the Organization of Petroleum Exporting Countries (OPEC), could bring about significant changes in the energy game. Iran is a member state of the SCO and a traditional good partner of China, and it is also a vital factor in providing energy security. In 2022, China imported over 700,000 bpd of oil by tankers from Iran

(Chen and Lawler, 2022). Oil from Iran and Saudi Arabia is delivered through sea lanes of communication (SLOCs) via tankers. Therefore, it is not surprising that China announced its rights and obligations to build itself into a maritime power and develop a blue water navy in 2015 (GOV.CN, 2015).

In providing energy security for China, Russia is one of the most important performers. Sino-Russian energy cooperation has intensified since 2005, when Russia's state-owned Rosneft began supplying oil to China via railway to service crucial Chinese loans, which had enabled the firm to buy Yuganskneftegaz, a key part of another Russian oil company, Yukos, which was nationalized following the jailing of fallen oligarch Mikhail Khodorkovsky (Gabuev, 2005). The very first grandiose energy project between China and Russia was named the Eastern Siberia-Pacific Ocean oil pipeline (ESPO). This pipeline is 4,188 km long and provides Asia Pacific markets of China, South Korea, and Japan with Russian oil. It was built by the Russian company in two phases. The first phase was completed in 2009 constructing an 800 km long pipeline from Taishet to Skorovodino. The second phase was completed in 2012, and it stretches from Angarsk to Daqing, a port in northeastern China. The second phase was intense in regard to China's national interests, because Russia announced that this eastern part of the oil pipeline should be finished in Nakhodka, a port cherished by Japan. For some scholars, construction of the eastern part of the pipeline represented the ideal type of the crisscrossing of new and old perceptions on security and cooperation (Hydrocarbons and Technology; Mitrovic, 2005). Their cooperation included a second big project, the realization from which was built the Power of Siberia gas pipeline. Through this pipeline, China annually imports 39 billion cubic meters of gas from Russia (Popovic, 2021).

One portion of the continental delivery of gas to China stems from the Central Asia-China gas pipeline which consists of four lines, A, B, C, and D. It begins in Turkmenistan and finishes in Xinjiang, China's north-western autonomous region. Lines A, B and C, which were completed in 2009, 2010, and 2014 respectively, each measure 1,833 km in length. Line D, with the length of 966 km, was constructed in 2022. Through this gas pipeline of four lines, all five Central Asian states together annually deliver 85 million of cubic meters of gas to China (Monitor Wiki – Global Energy, 2022).

Providing much needed energy via continental routes is understood as a security issue of top priority due to the high intensity situation in Xinjiang and a high possibility of terrorist attacks due to Uyghur separatism and ambition to create the

so-called "East Turkestan" state (Trailovic, 2021). So far, we can see that energy security has been provided by diplomatization and constructing big infrastructural projects. However, this real perception of domestic instability pushed China to introduce changes in manners as to how energy security should be secured.

In 1993, by a decision promulgated by the State Council, China initiated the realization of the plan to make petroleum strategic reserves. This decision was made official in 2001, when it was incorporated in China's Tenth Five Year Plan (2001–2005). The ultimate aim of this goal was to provide oil up to one hundred days if there occurred some new abruptions in oil supply as was the case with the first two oil shocks (Mitrovic, 2012; Mitrovic and Trailovic, 2014). This program was in progress by 2004; the first of these facilities, located in Zhenhai, was completed in August 2006, with a capacity to store 32 mbl of oil. The second, at Zhoushan (25 mbl), was completed in March 2007; the third and fourth, at Huangdao (25 mbl) and Dalian (25 mbl), were completed ahead of schedule, in December 2007. The first two of these are in the Zhejiang Province, south of Shanghai in east-central China, and the last two in the Shandong and Liaoning Provinces, both farther north in eastern China, respectively. All four SPRs, however, are located relatively near China's coast, with ready access to and from the sea (Cole, 2016, p. 146). Making petroleum strategic reserves influenced not only China's manner in pursuing diplomacy, but also China's view on sovereignty and strategy of containment which the USA in its documents such as the USA National Security Strategy and the USA National Defense Strategy from 2022, declared as an official way of dealing with China.

As the issue of energy security has become more pressing for China, the administration which directly tackles energy security has to evolve and rise China's resilience towards turmoil which can jeopardize China's energy security and thus further effect economic development and in the end the legitimacy of the CCP. When it comes to energy administration, as in many other areas of China's governance of the country, parallel levels of making decisions are represented. In this structured yet perplexing system, information is lost, splintered or is changed and can further cause even greater damage to China's sovereignty and pursuing strategies in securing national energy security. This problem was tried to be resolved in 2008 when the State Council of PR China initiated institutional reform which resulted in creating the National Energy Commission (NEC). The principle task of the NEC is strengthening energy decision-making and coordination (Downs, 2008; NEA-国家能源局). The same institutional reforms resulted in establishing the National Energy Administration (NEA - 国家能源局 – *guojia nengyun*

ju) that consists of 13 departments—the General Administration Department, Legal and Institutional Reform Department, Development and Planning Department, Energy Conservation and Technological Equipment Department, Power Department Nuclear Energy Department. Coal Department, Oil and Natural Gas Department, New and Renewable Energy Department, Market Regulation Department, Electricity Safety Supervision Department, International Cooperation Department, and the Party Committee Department (NEA-国家能源局). Erica Downs (2008) notices that the NEA has the lack of authority to set energy prices, which remains the purview of the National Development Reform Commission's Pricing Department. This same scholar argues that despite the growing importance of energy issues on China's domestic and foreign policy agendas, the country's bureaucracy lacks the capacity to manage the energy sector effectively. China's energy security was undermined by the very institutions responsible for enhancing it (Downs, 2008).

In conclusion, China's pursuit of energy security has been a complex and dynamic process that has forced the country to adopt innovative and creative diplomatic strategies. As China became increasingly dependent on imported energy resources, its leaders had to take a geopolitical look at the international order and pursue diplomatic solutions to secure its energy needs. China's approach to energy security has been to diplomatize the issue, defining it as a matter of diplomacy rather than securitizing it. This approach has enabled China to create a context in which the traditional framing of energy security in terms of classic geopolitics and global political economy is surpassed. As China's economic and diplomatic power continues to grow, its pursuit of energy security will remain a key priority in its domestic and international agenda.

3. Triangle: China-SCO-Energy Security

The previous part of the paper tackled some, amongst many, of China's bilateral cooperation with member states, dialogue partners, and observer states of the SCO. This part of the paper will analyze how energy cooperation is regulated on the SCO multilateral level and to what extent, if at all, it affects Chinese bilateral cooperation with the countries of the SCO Region. Bearing in mind the scope of this article, we will not analyze how and to what extent the SCO fight against the "three evils" (terrorism, separatism, and religious extremism) influences development of the SCO multilateral approach in securing energy security of its member states, dialogue partners and observer states.

The establishment of the SCO Energy Club aimed to promote energy cooperation and coordination among the SCO member states. The Club has served as a platform for regular meetings and discussions among energy ministers of the member states, as well as for sharing information and experiences in the field of energy. Its main objectives are to facilitate the development of energy infrastructure, enhance energy security, and promote the efficient use of energy resources. The SCO Club also aims to promote the use of renewable and clean energy technologies, as well as to develop regional energy markets and cooperation with other international organizations in the energy field (SCO Energy Club, s.a.). Overall, the SCO has recognized the importance of energy cooperation and security for the development and stability of the region. By promoting multilateral cooperation and diplomacy, the SCO has sought to diplomatize the challenges posed by energy security and to pursue sustainable development goals. The SCO Energy Club has played an important role in this regard by facilitating regular communication and coordination among the member states. In the same document SCO member states expressed their green mindset by emphasizing the importance of protecting the environment whilst pursuing strategies of securing energy security. This was done by stating that the member states will develop cooperation in the field of advanced environmental protection technologies, renewable and clean energy, and energy efficiency in order to support sustainable development (SCO, 2015). The importance of the energy cooperation within the SCO framework was accentuated in other documents. For that purpose, in the Samarkand declaration signed by SCO heads of member states in 2022, involved actors stressed the need to increase mutually beneficial cooperation in the energy sector, including the efficient use of all types of energy resources, and supporting the application of various efficient economically and environmentally friendly technologies that reduce negative environmental impact and promote energy security and the transition to cleaner and greener energy sources in an energy efficient economy (DigWatch, 2022).

Energy cooperation within the SCO on the multilateral level of the SCO was institutionalized by establishing the SCO Energy Club (hereinafter referred to as the Club). The Club was organized on the initiative of the Russian president, then Prime Minister, Vladimir Putin in 2006 during the SCO summit in Bishkek. This was a logical proposition, since geographically, the SCO Region covers both the world's biggest producers and importers and consumers of energy. This makes them mutually interdependent, which creates the basis for multilateral interaction. The Club could provide a suitable platform for such interaction (ИнфоШОС, 2015) and position the SCO as an even more influential factor in global governance. Two oil shocks demonstrated the power of states which export oil to direct

global trends. However, besides objectively positive preconditions and a more than obvious urgency of establishing a common SCO approach in securing energy security and emphasizing that economic cooperation in the SCO is a question of high priority, the institutionalization of the Club was a bumpy journey. According to the data offered by the ИнфоШОС (InfoSCO, 2015), the previous attempts to set up the Club failed due to a lack of consensus among the member states, first of all Uzbekistan. This was resolved by activating Article 16 of the SCO Charter (SCO, 2022) in which is stated:

> should one or several member States be not interested in implementing particular cooperation projects of interest to other member States, non-participation of the above member States in these projects shall not prevent the implementation of such cooperation projects by the member States concerned and, at the same time, shall not prevent the said member States from joining such projects at a later stage.

When the Club started to acquire its initial shape, it was based on an informal exchange of opinions among numerous interested states to be involved in the work of such an important institution. It resembled more a talk-show than an institution which tackles such an important issue. From the very beginning, this Club showed that its work will be based on inclusivity and not on exclusivity. Making it a non-elite club reserved only for the SCO member states, its participants first created the atmosphere of openness and trust. They believed that this kind of atmosphere is a precondition to discuss on an expert level about relevant economic, procedural, legal, and political topics with the aim not only to accelerate the foundation of the Club, but to make it a stable and durable institution. Eventually, such free discussions can result in specific proposals for government structures authorized to make the necessary decisions (ИнфоШОС, 2015). Basing the work of the Club on this kind of perception of openness and interconnectedness will require political agility and diplomatic wisdom. A tremendous step in that direction was done in 2017 when Turkey presided the Club.

So far, amongst experts there is an opinion that the Club as a format of cooperation would create a common style in resolving the following issues which are perceived as pressing for further development of the unique SCO energy cooperation:

- coordination of energy strategies and long-term programs for the development of the SCO member states and observers and dialogue partners;
- drafting and implementation of measures of common energy security;

- development of a system of transport energy communications;
- development of a joint economic mechanism for the implementation of the member states' energy policies;
- coordination of the member states' investment plans;
- information coordination;
- mutual informing about activities on the global energy market (*ИнфоШОС*, 2105).

Amongst these abovementioned tasks we can include more tasks such as construction of the infrastructure for the smooth flow of energy, defining a unanimous pricing system, defining common tax systems, how decisions will be made, and what kinds of cooperation this Club would develop with OPEC. The full list of tasks is not enlisted here, and they will emerge as cooperation increases.

Bearing in mind the geographic coverage of the SCO and geological structure of its member states, dialogue partners, and observer states, the Club possesses great potential to be one of the most important actors in global energy governance. But, still, it is more a paper tiger than an institutionalized power of the SCO which emerged from the common understanding of and view on regional and global energy interstate relations. SCO energy diplomacy is still in the developing phase, but there is an impression of not having a clear idea as to what should be the next step in achieving a common energy market or an understanding on energy security. There is no idea how to develop bilateral partnerships in a common multilateral arrangement such as the SCO Energy Club. Although there are some kind of multilateral arrangements for the SCO energy cooperation, its realization is more based on bilateral arrangements, which require attention, particularly in this part of the globe, that is, wider than the SCO Region. The constant creation of a dense bilateral network of energy agreements which are not based on previously defined and transparent multilateral rules will only make it more difficult for the SCO countries to specify a common approach of energy cooperation. In that logic, Xu Xiaojie (2011, p. 163), advocates that it is more difficult to govern and secure daily operations of the cross-border transportation system within the framework of several bilateral agreements since any bilateral dispute could ignite multilateral interests. There is no way to govern the transportation system based on a combination of individual bilateral agreements. If countries involved in the SCO are as partners striving to achieve China's ideal that Asian security belongs to Asian people, SCO energy diplomacy and cooperation should be more progressive when it comes to such things.

It is true that the lack of a maritime aspect within the institutional structure of the SCO poses a challenge for the organization's efforts to promote common energy cooperation. As it was mentioned, the maritime areas within the SCO region are crucial for the smooth flow of energy resources, and the absence of a mechanism for defining SCO rules in maritime governance may lead to individual member states prioritizing their own national interests in this regard. This is further complicated by the fact that some SCO member states may prefer to rely on security initiatives offered by other states, such as India's participation in the Quad (Quadrilateral Security Dialogue). Moreover, the lack of a dedicated SCO Development Bank and the ad-hoc nature of the SCO Interbank Consortium and SCO Business Club also pose challenges for promoting common energy cooperation within the SCO framework. Without a strong and continuous financial support mechanism, the development of an energy infrastructure and the implementation of energy projects that contribute to a common SCO energy approach may be hindered. It is important for the SCO to address these challenges in order to effectively promote energy security and cooperation within the SCO Region.

In conclusion, it is evident that energy security represents a high priority question on the agenda of China's domestic and international politics. Despite being heavily reliant on imported energy resources, China has avoided securitizing this question and instead defined it as a matter of diplomacy, emphasizing the idea that the world belongs to all people. By doing so, China has created an institutional context in which a militaristic control of energy sources and routes is surpassed. Energy cooperation is also a key priority for the Shanghai Cooperation Organization (SCO), and it has been labeled as one of the most important pillars and aims of future cooperation. However, the lack of a maritime aspect of the SCO and the absence of a strong and continuous financial support system for energy infrastructure development may hinder the promotion of a common SCO energy approach. Therefore, in order to achieve a holistic approach to energy security, the SCO needs to address these issues and engage in more multilateral cooperation.

5. Conclusion

Acquiring energy security has driven China to become more proactive in its diplomatic initiatives, offering innovative and creative solutions for global challenges that can jeopardize global stability. Without stability, China's development is at risk since its actions have become global in character. The expectation for China

to be constructive and responsible for global development is increasing, and it is well-known that there is no development without energy.

This paper analyzes China's bilateral and multilateral relations on energy security as a part of China's more proactive role in the regional energy governance platform. The focus is on the influence of the SCO Energy Club as a regional energy governance platform on China's strategies and urgent need to secure its energy security. The paper demonstrates that China takes an incremental approach in securing energy security, making it a matter of diplomacy, relations, and partnerships. China did not securitize this issue by transforming it into an excuse for pursuing hegemonism, power politics, or instigating a weaponry race. Instead, China pursues the approach to create multilateral rules from constantly evolving bilateral relations between countries, combining both approaches. However, this approach has given modest results so far, as countries tend to view securing energy security as a vital national interest better achieved through bilateral negotiations than multilateral arrangements. This could be seen as a Chinese strategic patience, yet to be fully realized. The first step towards changing the mindset from a bilateral to a multilateral viewpoint in securing energy security is for countries involved in the work of the SCO to recognize that creating a common approach and partnerships of sharing, even in energy security, is better than pursuing selfish national interests. Through sharing and creating a wider range of relations, a context is created in which negative influences that can jeopardize national security and development can be better controlled. Oil shocks teach us this.

The success of the SCO Energy Club depends on many factors, among which urgent financial integration and defining the SCO maritime aspect of cooperation are highlighted. The SCO Energy Club possesses great potential to be one of the most active actors in not only regional but also global energy governance, together with OPEC. It remains to be seen whether the SCO's energy potential will shape a new SCO face and future development, particularly from the perspectives of nuclear energy and green hydrogen. So far, the SCO Energy Club does not have any influence on internationalization of the yuan, that is, making it "Petro Yuan".

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The Comparison of Digitalization Based on Innovation or Economic Development Through Bibliometric Analysis Between Asian Countries and European Countries

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Abstract: Countries worldwide are undergoing a rapid digitalization and innovation to create smarter and more sustainable urban environments. This study explores the progress made in this regard by comparing the efforts of Asian countries and Europe through bibliometric analysis. The analysis focuses on one main area: digitalization based on economic development or innovation, and three sub-areas: smart city, digitalization in accounting, green innovation, and green economic development. These sub-areas are chosen based on their impact on both economic and financial development.

Using a range of bibliometric indicators, including publication output, citation impact, and collaboration patterns, this study compares the performance of Asian countries and Europe in these areas. This study covers publications between 1997–2023 collected from the Web of Science and not restricted to only Asian and European countries.

The results reveal interesting insights into the progress of both regions. While Asian countries, such as China and South Korea, have made significant strides in innovation and digitalization, the United Kingdom, Sweden, and some countries from Europe have been at the forefront of smart city development. The study also highlights the challenges faced by both regions in creating smart cities.

Overall, this study concludes that bibliometric analysis provides a valuable tool for comparing the progress made by different regions and illustrates the significance of these areas in the past, present, and future. By identifying areas of strength and weakness, public and private sectors can better understand the challenges they face and develop more effective strategies.

Keywords: Bibliometric Analysis, Digitalization, Economic Development, Innovation, Smart City.
JEL: O00, O10, O32, C00, C88

1. Introduction

Digitalization plays a crucial role in driving economic growth and fostering innovation. By embracing digital technologies and leveraging their potential, businesses and economies can unlock new opportunities. The relationship between digitalization, innovation, and economic growth has surpassed mere interconnectedness, and their impact on each other has become profoundly significant. Innovation plays a vital role in shaping smart cities. This involves the development and application of new technologies, solutions, and business models to address urban challenges and improve urban services. The combined efforts of digitalization and innovation in smart cities have a direct impact on economic growth, augmenting productivity, attracting investments, and generating fresh economic prospects through the effective utilization of digital technologies and data-driven insights. By leveraging digital technologies and data-driven insights, cities can enhance productivity, attract investment, and create new economic opportunities.

Accounting is one of the main steps that plays an important role in digitalization. By embracing digital accounting systems and practices, businesses can streamline financial processes, automate data entry and reconciliation, and improve financial reporting accuracy.

The adaptation process of digitalization and related concepts, which are profoundly influenced by digitalization, varies significantly from country to country. Socioeconomic, cultural, and social factors contribute to these differences. Additionally, each country possesses its own unique technological infrastructure, economic conditions, and industrial structure.

We sought to undertake a comprehensive evaluation of scientific research conducted worldwide on these subjects, considering the universal recognition that these topics pertain to the past two to three decades and are subject to rapid and continuous change. In addition, we aimed to determine the regions of the world that have focused more intensively on these topics. Furthermore, we sought to examine the situation in countries, such as Singapore and Japan, which are often regarded as leaders in these areas when it comes to discussions related to these subjects.

The subsequent section of this study presents an in-depth examination of the conceptual framework encompassing innovation and its relationship to economic growth, with a specific emphasis on the phenomenon of digitalization. In

section 3, we describe the research methodology and identify a sample of papers for further analysis. Section 4 encompasses a comprehensive presentation of the obtained results and an extensive discussion thereof.

2. Innovation or Economic Development Concepts and Digitalization

Innovation plays a crucial role in driving economic development, as it leads to the creation of new products, services, and business models that can increase productivity, create jobs, and stimulate economic growth. Studies have demonstrated the link between innovation and economic development (Liu, Si and Li, 2023; Zhong and Chen, 2023) as World Intellectual Property Organization (WIPO) showed that countries that invest in innovation tend to have higher economic growth rates, higher levels of productivity, and greater competitiveness in the global marketplace (WIPO, 2018). The study found that innovation can contribute up to 80 percent of economic growth in some countries (WIPO, 2018). Another study by the Organization for Economic Co-operation and Development (OECD) found that innovation can lead to higher wages and greater income equality (OECD, 2010). The study also found that innovation is essential for addressing global challenges such as climate change, health, and food security (OECD, 2010). Furthermore, according to the McKinsey Global Institute (MGI) companies that prioritize innovation tend to have higher revenue growth, higher profit margins, and greater market share than companies that do not (MGI, 2018). For this reason, innovation is becoming increasingly important in Asian countries as they strive to achieve economic growth and development. The following Asian countries are the forerunners of economic development for the last decade (OECD, 2010):

South Korea: South Korea has become one of the most innovative countries in the world, with a strong focus on technology and research and development (R and D) (Dayton, 2020). This has helped South Korea to become a global leader in industries such as electronics, semiconductors, and automotive manufacturing (GII, 2021). According to the Global Innovation Index (GII) 2021 South Korea ranked 1st in R and D expenditures and 2nd in the innovation output sub-index (GII, 2021).

Singapore: Singapore has also made innovation a key part of its economic development strategy. The government has implemented policies and initiatives to support innovation, such as funding for R and D, tax incentives for innovative companies, and the creation of innovation hubs (GII, 2021; Tan and Phang, 2005). As

a result, Singapore has become a hub for startups and has attracted investments from global companies. According to the GII 2021, Singapore ranked 3rd overall and 1st in the innovation input sub-index (GII, 2021).

China: China has become a major player in innovation with a focus on developing advanced technologies, such as artificial intelligence (AI) and 5G. The Chinese government has made significant investments in R and D, and has created policies to encourage innovation, such as the Made in China 2025 initiative (GII, 2021). According to the GII 2021, China ranked 12th overall and 1st in the quality of scientific publications sub-index (GII, 2021). In various academic inquiries examining the case of China, it has been observed that AI significantly impacts green total factor productivity (Zhao, Gao and Sun, 2022; Qian, Liu, Shi, Forrest and Yang, 2023).

India: India has also been focusing on innovation as a key driver of economic growth. The government has implemented policies and initiatives to support innovation, such as the Startup India initiative and the Atal Innovation Mission. India has also been investing in R and D and has become a hub for IT services and software development (GII, 2021; Joshi, 2008). According to the GII 2021, India ranked 46th overall and 3rd in the quality of scientific publications sub-index (GII, 2021).

Digitalization also plays a critical role in economic development, as it can lead to increased productivity, improved efficiency, and new opportunities for innovation and growth (OECD, 2019b). By embracing digital technologies and leveraging their potential to innovate and grow, businesses and governments can create new opportunities for economic growth and development (Deloitte, 2020). Digitalization can also become a way of creating new job opportunities in areas such as software development, data analytics, and digital marketing (World Economic Forum, 2020). Digital tools, such as Enterprise Resource Planning (ERP) systems, customer relationship management systems, and data analytics software, can help businesses optimize their operations and improve their bottom line by automating routine tasks and providing real-time data and analytics for decision-making (OECD, 2019b). For example, digital platforms, such as e-commerce marketplaces and online payment systems, can help businesses to reach new customers and expand their operations globally, leading to new opportunities for growth (Deloitte, 2020). In addition, digitalization can improve efficiency by reducing the time and resources required to perform tasks, such as document management, inventory tracking, and financial reporting. This can

help businesses to operate more efficiently and reduce their costs (OECD, 2019b). Overall, digitalization can have a significant impact on economic development, both in developed and developing countries. While some jobs may be replaced by digitalization, new jobs will also be created in areas such as data analysis, cybersecurity, and digital marketing, leading to a potential net increase in employment opportunities (World Economic Forum, 2020).

Digitalization and innovation are closely interconnected as digital technologies can facilitate and drive innovation, and innovation can lead to new digital solutions and applications. For example, digital platforms can enable new business models and ways of delivering services, while data analytics can provide insights that drive innovation and improvements (Deloitte, 2019). Innovation can also lead to the creation of new digital solutions and applications. For example, innovative new products and services, such as mobile apps and cloud-based software, can leverage digital technologies to provide new capabilities and benefits to users (Gassmann, Frankenberger and Csik, 2017). Digitalization can also enable new forms of innovation, such as open innovation and crowdsourcing. These approaches involve leveraging the collective knowledge and expertise of a wider community of stakeholders to drive innovation and develop new solutions (OECD, 2019a). Overall, the relationship between digitalization and innovation is one of mutual reinforcement as each can drive and enable the other. By embracing digital technologies and leveraging innovative approaches, businesses and organizations can create new opportunities for growth and development.

Green innovation refers to the development and adoption of new technologies, products, and services that have positive environmental impacts, such as reducing greenhouse gas emissions, improving energy efficiency, and promoting sustainable practices (Meidute-Kavaliauskiene, Çiğdem, Vasiliauskas and Yıldız, 2021). Major contributions of green innovation to economic development can be summarized as follows:

Creating new markets and opportunities: Green innovation can create new markets and business opportunities in areas such as renewable energy, green building, and sustainable transportation. These new markets can drive economic growth and job creation, while also promoting sustainability (UNEP, 2016).

Enhancing competitiveness: Green innovation can also enhance the competitiveness of businesses and industries, by enabling them to develop new products and services that meet the growing demand for sustainable solutions (OECD, 2012).

In addition, green innovation can help businesses reduce costs and increase efficiency, by promoting resource efficiency and reducing waste.

Addressing global challenges: Green innovation can also play a critical role in addressing global challenges, such as climate change, air and water pollution, and resource depletion. By developing and adopting sustainable solutions, countries can reduce their environmental impact and contribute to a more sustainable future (World Bank, 2021).

Overall, green innovation can contribute to economic development by creating new markets and opportunities, enhancing competitiveness, and addressing global challenges. By promoting green innovation, governments and businesses can foster sustainable economic growth while also promoting environmental sustainability.

Green innovation and digitalization are closely related and can support each other in multiple ways. Digitalization can provide new tools and technologies that enable green innovation such as smart grids, renewable energy management systems, and digital simulations for designing and testing sustainable products and services (Hashem, Yaqoob, Anuar, Mokhtar, Gani and Khan, 2015). Additionally, the process of digitalization can contribute to the attainment of sustainability goals by fostering resource efficiency, mitigating waste generation, and advancing the principles of a circular economy (Maiurova, Kurniawan, Kustikova, Bykovskaia, Othman, Singh and Goh, 2022). Moreover, digitalization can enable new business models that support sustainability, such as platform-based sharing and circular economy models. These models can promote resource efficiency, reduce waste, and provide new opportunities for economic development (UNEP, 2019). In summary, digitalization can play a critical role in driving sustainable economic growth and reducing environmental impact by enabling and promoting green innovation and sustainability.

From an accounting perspective, digitalization can have significant implications for financial reporting, auditing, and taxation (AICPA and CPA Canada, 2019). One of the key benefits of digitalization for accounting is the potential for automation and standardization of financial processes. Digital tools, such as accounting software, robotic process automation, and blockchain, can streamline tasks such as data entry, reconciliation, and reporting reducing the risk of errors and improving the efficiency and accuracy of financial information (PwC, 2018). Moreover, digitalization can enable more timely and relevant financial reporting,

with real-time access to financial data and performance metrics. This can provide stakeholders with a more comprehensive and up-to-date picture of the company's financial position and performance which can support the decision-making process. However, digitalization can also present new challenges for accounting (Gulin, Hladika and Valenta, 2019). For example, the increasing use of cloud computing and digital storage of financial data raises concerns about data security and privacy (Richins, Stapleton, Stratopoulos and Wong, 2017). In summary, from an accounting perspective, digitalization can offer significant benefits in terms of efficiency, accuracy, and relevance of financial information. But it also presents new challenges that need to be addressed to ensure the integrity and security of financial data and to comply with evolving regulatory requirements.

3. Research Methodology

Publications in the field of the main areas, such as digitalization, innovation, and economic development, have gained increasing attention, along with the subareas, such as green innovation and green economic development, to create smarter and sustainable urban environments. We divided countries into two basic regions for detailed comparisons by using multiple bibliometric indexes. Region 1 includes Asian countries and Region 2 includes European countries. To provide a comprehensive assessment, numerous indicators were consolidated in the analysis of the study. Three main indicators including the number of publications, the most cited countries, and authors were initially selected for assessing the quantity and quality of the publications based on these areas. In addition, the relation of three elements, countries, authors, and keywords are identified based on these groups and the differences between the regions are examined. This study will offer assistance to distinguish the key concepts in this area of research and may uncover rising patterns and new directions for future studies.

To comprehend the deviation in innovation and economic growth to the side that deals with the importance of environmental facts, this study draws on bibliometric methodology. This methodology is a common and rigorous method for investigating and analyzing large amounts of scientific data. This type of analysis allows researchers to uncover the nuances of a particular field's evolution while shedding light on new areas in that field (Albort-Morant and Ribeiro-Soriano, 2016). In addition, a bibliometric analysis using keywords enables the analysis of specifics in the primary research topics within a domain and relationship at the micro level (Chen and Xiao, 2016). This type of analysis also generates useful

information for researchers evaluating scientific activity (Rey-Martí, Ribeiro-Soriano and Palacios-Marqués, 2016).

Bibliometric analysis has recently gained huge popularity in business research (Albort-Morant and Ribeiro-Soriano, 2016; Donthu, Kumar and Pattnaik, 2020a; Donthu, Kumar, Pattnaik and Lim, 2021; Khan, Pattnaik, Ashraf, Ali, Kumar and Donthu, 2021). The emergence of scientific databases, such as Scopus and Web of Science (WoS), has made it significantly easier to gather substantial amounts of bibliometric data. Additionally, the availability of bibliometric software like Gephi, Leximancer, and VOSviewer has facilitated the analysis of this data in a practical manner. This has led to a recent increase in scholarly interest in bibliometric analysis (Donthu et al., 2021, p. 286). In fact, the bibliometric methodology has been used in business research areas, such as business strategy (Kumar, Surekha, Lim, Mangla and Goyal, 2021; Villa, Ruiz, Valencia and Picón, 2018), electronic commerce (Bawack, Wamba, Carillo and Akter, 2022), finance (Ahmi, Tapa and Hamzah, 2020; Baker, Kumar and Pandey, 2021; Durisin and Puzone, 2009; Elie, Granier and Rigot, 2021; Linnenluecke, Chen, Ling, Smith and Zhu, 2017; Xu, Chen, Jia, Brown, Gong and Xu, 2018; Zhang, D., Zhang, Z. and Managi, 2019), human resources (Andersen, 2019; Bahuguna, Srivastava and Tiwari, 2023; Danvila-del-Valle, Estévez-Mendoza and Lara, 2019), management (Ellegaard and Wallin, 2015; Zupic and Čater, 2015), and marketing (Backhaus, Lügger and Koch, 2011; Donthu et al., 2020a; Donthu, Kumar and Pandey, 2020b; Donthu, Kumar, Pandey and Soni 2020c; Hu, Song and Guo, 2019; Samiee and Chabowski, 2012; Ye, Hudders, De Jans and De Veirman, 2021). The application of bibliometrics ranges from studying publications to analyzing collaboration trends to examining the intellectual hierarchy of the research field. Journals may also represent the research field in this instance. The bibliometric analysis has been used to provide retrospectives of journals, such as the Journal of Business Research, which typically happen in landmark years (Donthu et al., 2020a).

This study introduces bibliometric methods by Biblioshiny for a comprehensive review of innovation, digitalization, and economic development. The main aim of the study is to examine the growth and trend of the research in digitalization based on innovation or economic development with the subgroups defined as smart city, digitalization in accounting, green economic growth in case of sustainability, and to comprehend the distribution of the countries that contribute these research areas. With the help of this examination, we investigate the globally cited documents and themes depending on these research areas. In addition,

we can identify the direction of future thematic research based on the main group and the subgroups of the study.

3.1. Keywords Define and Data Collection

In order to examine bibliographic information, the studies were gathered from the online WoS database's Social Science Citation Index which includes thousands of scholarly articles and bibliographic data on authors, affiliations, and citations. Since the analysis focuses on the main areas, such as digitalization based on innovation or economic development, with three sub-areas, such as green economic growth or green innovation, digitalization in accounting, and smart city. The keywords for the data collection for each group are represented in Table 1.

Table 1. Groups of the Study

Group	Keywords
Group 1	Green Innovation AND Green Economic Growth AND (Digitalization OR Digital Transform OR Digitalisation)
Group 2	(Digitalization OR Digital Transform OR Digitalisation) AND (Innovation OR Economic Growth) AND *Accounting*
Group 3	(Digitalization OR Digital Transform OR Digitalisation) AND (Innovation OR Economic Growth) AND *Smart City*
Group 4 (Main Group)	(Digitalization OR Digital Transform OR Digitalisation) AND (Innovation OR Economic Growth)

In the study, the words such as "digital transformation" were not added as keywords because all studies that include digital transformation also encompass "digital transform". For instance, the studies included in Group 1 should encompass the concepts of green innovation, green economic development, and digitalization simultaneously. In the second group, studies should consist of an examination of the concepts of accounting, digitalization, and innovation together, or an examination of the concepts of accounting digitalization and economic growth together.

In this study, although the aim is to compare Asian and European countries in the identified areas, it is also important to know in which countries outside these regions the research in this field has taken place. Therefore, studies that were not conducted in these two regions have not been excluded from the analysis, recognizing the significance of understanding the broader geographical distribution of research in the field.

3.2. Data Analysis

This study employs two analytical tools, Excel and the Biblioshiny application of the R package. Excel has been used to clean the dataset and generate descriptive statistics and basic graphs. Biblioshiny has been used to produce basic indicators of the study to produce collaboration networks. Its web-interface tool provides visualizations with high readability and understandability.

The time span of the collected data of Group 4, which is the main group of the study, ranges from 1997 to 2023. Table 2 illustrates the main information about the dataset of each group. The documents in Group 4 were published in 2237 sources with an average citation score of 7.54. The time span of the subgroup (Group 1), based on green innovation and green economic growth, ranges from 2019 to 2023, and they were published in 22 sources with an average citation score of 6.82.

Table 2. Distribution of Document Types of Each Group

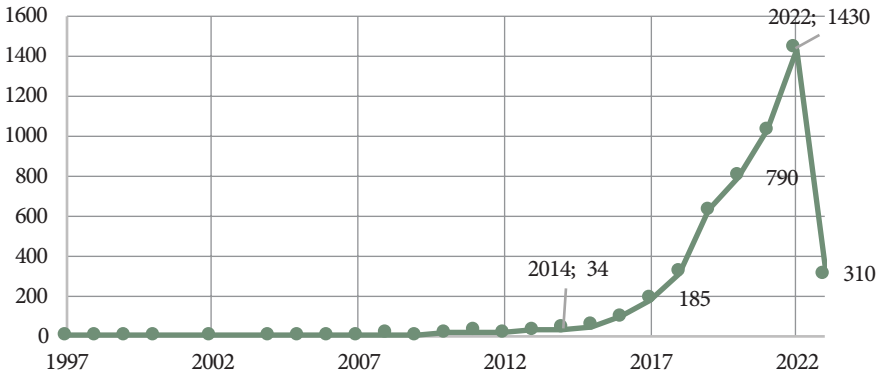
Main Information About Data	Group 4	Group 3	Group 2	Group 1
Timespan	1997–2023	2016–2023	2013–2023	2019–2023
Sources (Journals, Books, etc.)	2237	58	80	22
Documents	5216	67	98	34
Average years from publication	2.79	3.08	2.02	1.06
Average citations per documents	7.541	9.164	5.173	6.824
Average citations per year per doc	1,934	2.16	1.709	2.842
References	203539	3032	4998	2327
Article		32	60	32
Article, Early Access		3	9	2

Source: compiled by the authors based on Bibliometric Analysis.

As observed from Table 2, the time span of the subgroup (Group 2) focused on digitalization in accounting ranges from 2013 to 2023. These studies were published in 80 sources, with an average citation score of 5.17. Additionally, the time span of the subgroup (Group 3) focused on smart cities ranges from 2016 to 2023. These studies were published in 58 sources, with an average citation score of 9.16.

Figure 1 illustrates the number of papers published each year in Group 4. It should be noted that Figure 1 does not include early access documents and similar figures. From 2014 to 2022, there is an increasing trend in publications. The lower value in 2023 is due to the sampling inclusion of studies published in the first three months of the year.

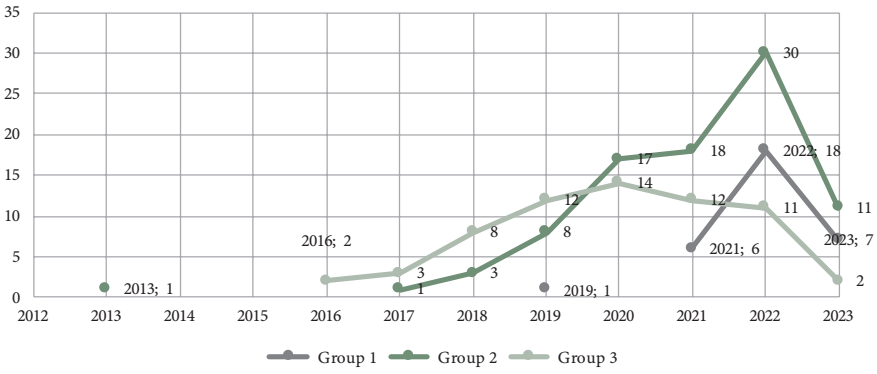
Figure 1. Annual scientific production of Group 4: 1997–2023



Source: compiled by the authors based on Bibliometric Analysis.

The number of papers published each year for the remaining groups is depicted in Figure 2. In Group 2, the initial publication emerged in 2013, and this particular subarea remained largely unexplored until 2017. Subsequently, a noteworthy and significant surge in research activity is evident beyond 2017, indicating a bullish development in the field.

Figure 2. Annual scientific production of Group 1, 2 and 3: 2013–2023

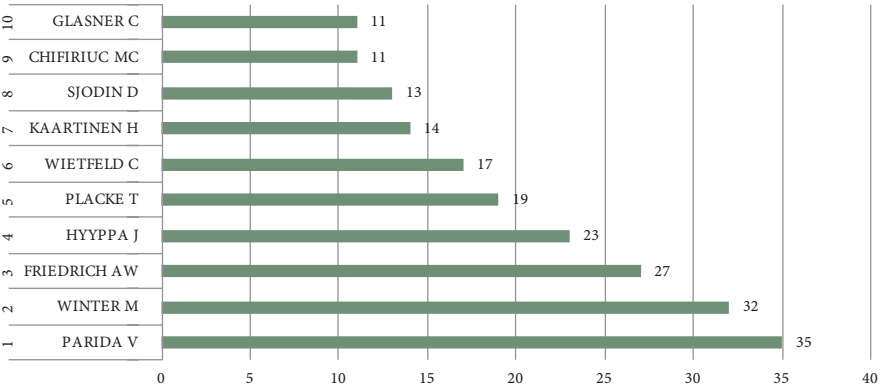


Source: authors' elaboration using Biblioshiny.

As depicted in Figure 2, within Group 1, the inaugural paper was published in 2019, signifying a relatively recent exploration of this specific subarea which remained largely unexplored until 2021. Furthermore, Figure 3 presents the top

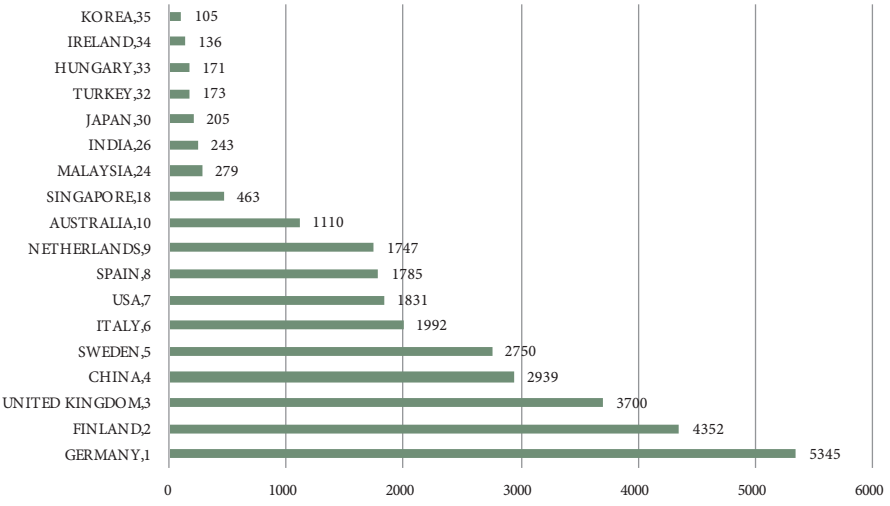
ten researchers who have contributed to the primary domain of the study. At the forefront is Parida Vinit, with a remarkable 35 publications. Following closely on the list is Winter Martin, with an impressive count of 32 publications.

Figure 3. Authors with higher production: Group 4



Source: compiled by the authors based on Bibliometric Analysis.

Figure 4. Total Citation of Group 4 with ranking information



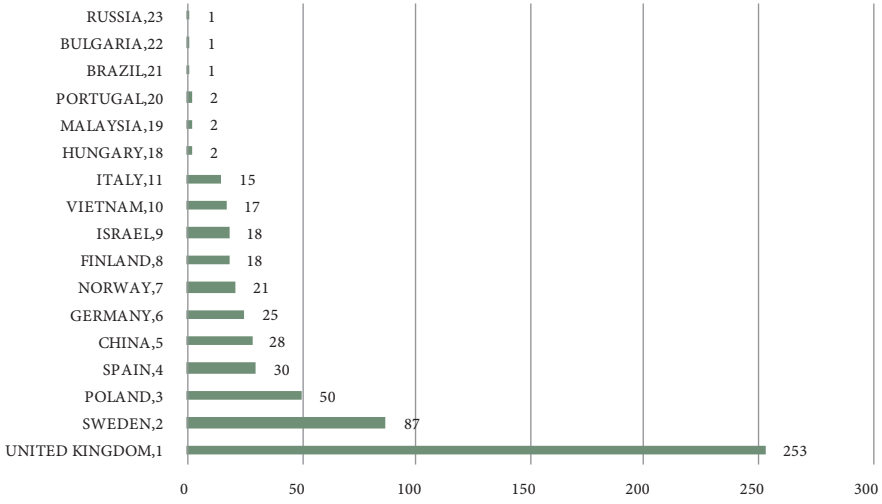
Source: compiled by the authors based on Bibliometric Analysis.

One of the essential factors in determining the impact of a publication is the number of citations. Figure 4 illustrates the top 10 highly cited publications' countries from all over the world with some other countries from Region 1 and Region 2. These countries are not the countries under study; rather, they represent the countries where the institutions/universities employing the researchers who conducted the study are located. Considering that China is the sole country from Region 1 to appear in the top 10 highly cited countries globally, the remaining countries from both Region 1 and Region 2 were included with rank information in a non-biased manner. This approach was adopted to facilitate the understanding and comparison between Region 1 and Region 2.

Despite the implementation of innovation-supportive policies and initiatives, such as R and D funding, by the Singaporean government, their current position of 18th in the overall citation ranking may be considered relatively modest when compared to the extent of their innovation-driven implementations.

Figure 5 displays the top ten countries with the highest number of citations for their publications, including some additional countries from Region 1 and Region 2. China and Vietnam are the countries from Region 1 that are in the top 10 list.

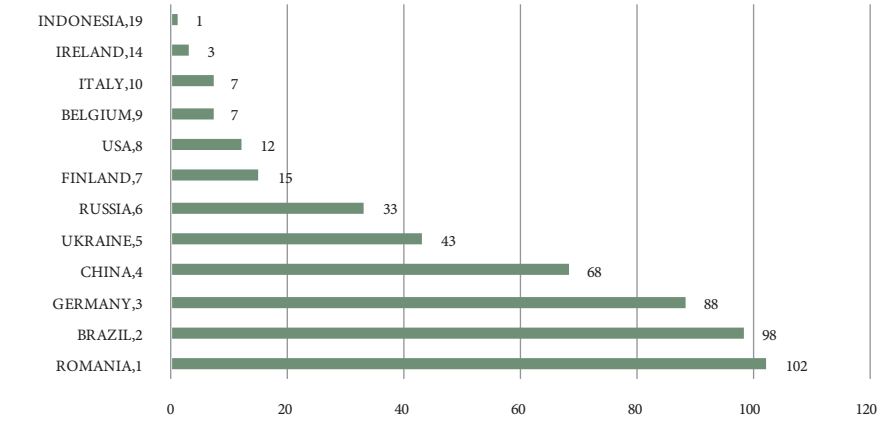
Figure 5. Total citation of Group 3 with ranking information



Source: compiled by the authors based on Bibliometric Analysis.

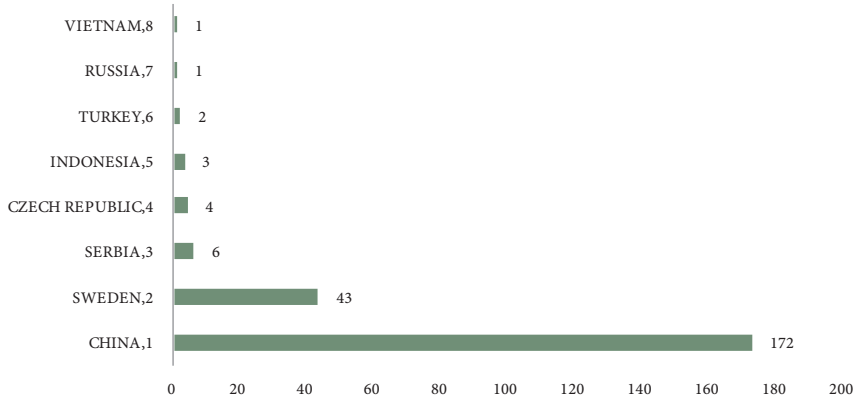
Figure 6 illustrates the ranking graph of the top ten cited countries that depend on digitalization in accounting with the ranking information of Ireland and Indonesia. Figure 6 provides valuable information about the research influence of Group 2, but it should be considered in the context of other bibliometric factors that may impact research quality. The high number of citations implies that Romania is making vital contributions to the field of digitalization in accounting, and the country is a key player in this quickly developing field of study and practice.

Figure 6. Total citation of Group 2 with ranking information



Source: compiled by the authors based on Bibliometric Analysis.

Figure 7. Total citation of Group 1 with ranking information

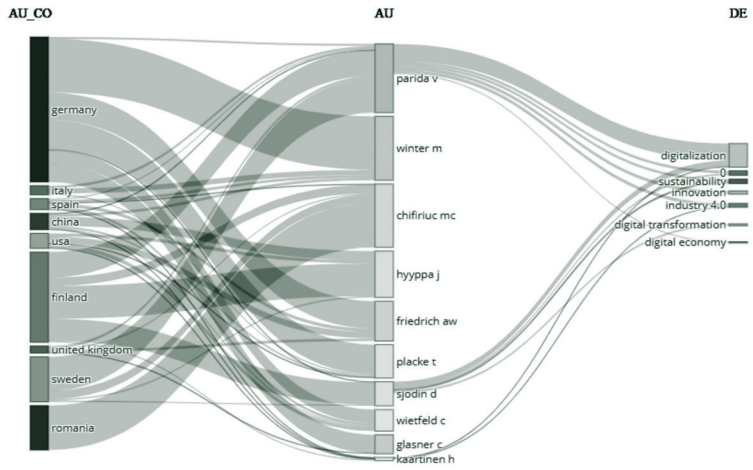


Source: compiled by the authors based on Bibliometric Analysis.

Figure 7 illustrates the ranking graph of the top ten cited countries that depend on the main area with the concept of environmental facts. The high number of citations implies that China is making vital contributions to this field. Countries from Region 2, such as Turkey, Indonesia, Vietnam, and Russia, have the highest number of publications and belong to the top 10 list.

The three fields plot shown in Figure 8 is an illustration of three crucial elements, consisting of a list of the top ten authors' countries, authors, and the studies' keywords. These three elements are plotted with gray linkages that show their relationship with each other. The size of each rectangle in each list indicates the number of papers associated with that element. Additionally, the countries associated with the authors represented in Figure 8 and similar figures also indicate the countries of the co-authors involved in the relevant author's works on that subject, apart from the country of the respective author. The information can be found under the 'countries' section on the relevant author's page in the Web of Science database[1] to find co-authors who have collaborated with the respective author, to verify its accuracy. However, the co-author information obtained from this link encompasses not only the WoS database, but also all the studies scanned on the internet.

Figure 8. Illustration of three elements, consisting of a list of countries, authors, and keywords: Group 4

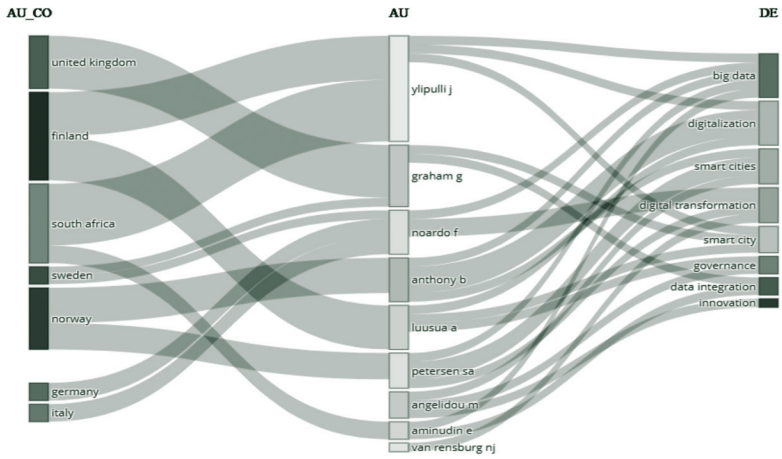


Source: compiled by the authors based on Bibliometric Analysis.

1 The database can be accessed at the following link: https://app.dimensions.ai/discover/publication

Apart from the topics that define the main group, the most commonly used keywords are sustainability and industry 4. As illustrated in Figure 8, Germany emerges as the country that places the greatest emphasis on research about these subjects. The country with the most scientific studies on these issues outside of Europe is China. In fact, no other Asian countries besides China ranks within the top ten countries with the most research on these issues. Similar figures were generated for each subarea to analyze the progress of the subareas that are associated with the main area. In addition, Figure 9 displays this illustration based on the smart city concept.

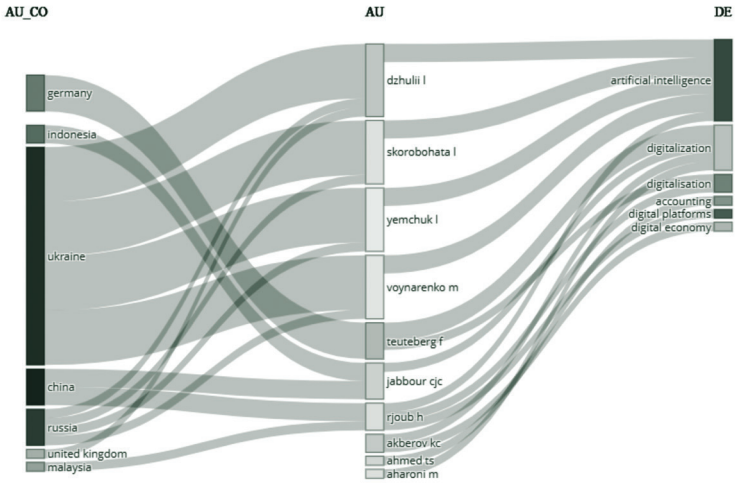
Figure 9. Illustration of three elements, consisting of a list of countries, authors, and keywords: Group 3



Source: compiled by the authors based on Bibliometric Analysis.

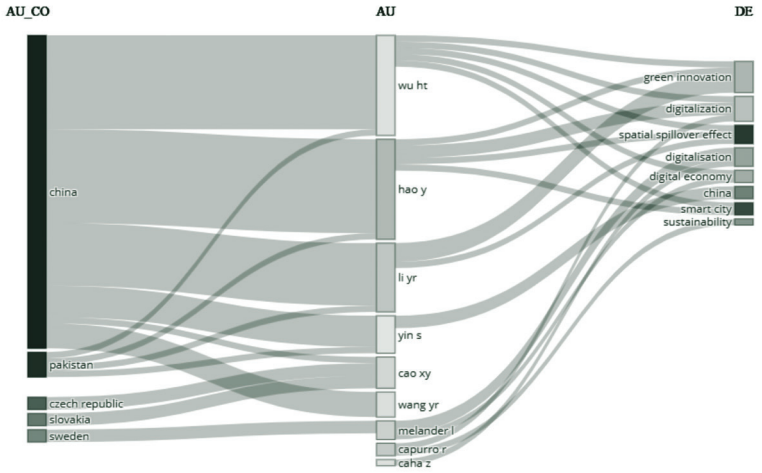
Apart from the topics that define Group 3, the most used keywords are big data and building information modeling (BIM). The countries that give more importance to related studies are from Region 1. Interestingly, South Africa is the only region that ranks within the top ten countries with the most research based on the smart city that does not belong to Europe. Figure 10 displays the illustration of three elements based on the sub-area digitalization in accounting.

Figure 10. Illustration of three elements, consisting of a list of countries, authors, and keywords: Group 2



Source: compiled by the authors based on Bibliometric Analysis.

Figure 11. Illustration of three elements, consisting of a list of countries, authors, and keywords: Group 1



Source: compiled by the authors based on Bibliometric Analysis.

Ukraine is the country that gives the most importance to related studies based on digitalization in accounting. China, Malaysia, and Indonesia are the countries that rank within the top ten countries with the most research on digitalization in accounting. Apart from the topics that define Group 2, the most used keywords are sustainability, artificial intelligence, and digitalization of the economy. Figure 11 displays the illustration of three elements based on the sub-area green innovation and green economic growth.

China and Pakistan are the countries that belong to Region 2, and rank within the top ten countries with the most research on sub-area depending on the environmental facts. Apart from the topics that define Group 1, the most used keywords are sustainability, digital economy, digital green innovation, and spatial spillover effect.

4. Conclusion

This study provides a systematic review of the topics of digitalization and innovation, or digitalization and economic growth, encompassing pertinent sub-topics including accounting, smart cities, and environmental factors such as green economic growth and green innovation. While the main topic of the study has garnered a significant number of published papers, scholarly attention towards the sub-topics has emerged relatively recently within the past few years. This suggests a growing interest in these domains and implies a likely concentration of future studies in these areas. Additionally, the groups analyzed in the study have been defined as specific groups obtained through the confluence of specific and significant concepts. Although it is an important finding to examine the studies conducted in this field and observe their increase over time, it has emerged that the actual starting years of collaboration in these areas are relatively late.

The present study endeavors to conduct a regional comparison in order to ascertain the countries that prioritize these areas to a greater extent. The findings indicate that China, among the Asian countries, has demonstrated a noteworthy level of engagement and interest in these fields and their associated domains as in the GII. When considering country rankings, it is notable that among the groups other than Group 1, no country from the Asian region is present in the top three. Interestingly, in Group 2, Romania ranks first, which may be attributed to its implementation of accounting-related regulations. Additionally, this indicator serves as a promising sign of the increasing scholarly interest in the subject

over time. However, it is crucial to acknowledge that the study's focus on mostly English-language articles exclusively screened within the Web of Science (WoS) database may lead to the exclusion of certain countries from this ranking.
Based on the observations derived from Figure 8–11, it is evident that the prominent authors within the groups engage in research endeavors involving international collaborations. Notably, Figure 10 highlights that among the top 10 authors, there exists an individual who has a connection with the United Kingdom and China as well. This connection implies the occurrence of joint research initiatives between this author and universities in China, likely facilitated by their association with the university in the United Kingdom. It can be anticipated that these collaborative efforts will gain increasing significance over time, primarily due to the inherent relevance of the conceptual frameworks employed. Consequently, such collaborations are expected to stimulate a rise in the number of authors engaging in cooperative research activities within their respective nations.

It is crucial to acknowledge that, like any study, our research is subject to a set of limitations. The primary limitation stems from the fact that the analysis was restricted to articles included within the WoS database, thereby encompassing only a specific set of documents. Another limitation to consider is the reliance on keywords used to define the groups. Altering the definitions of these groups by broadening or narrowing down their scope in accordance with one's specific research interests may yield disparate outcomes.

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Comparative Advantage and Policy Analysis of Pakistan's Rice (Paddy) Sector

Reema Zia

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Abstract: The study applied the Policy Analysis Matrix (PAM) approach to examine the comparative advantage of Pakistan's rice (paddy) sector and to assess the role of government policies in the production and trade of Basmati and IRRI (International Rice Research Institute introduced variety) rice for the harvesting years 2013–2014 and 2017–2018. From the outcomes it was clear that production of Basmati paddy in Pakistan and Punjab was profitable for export purpose, which was confirmed by the Social Benefit Cost (SBC) and Domestic Resource Cost (DRC) analyses. While the DRC and SBC ratio of IRRI paddy for Pakistan and Punjab depicted a comparative disadvantage of these regions in IRRI production, whereas only Sindh showed a comparative advantage in IRRI production in 2017–2018. It was evident from the Nominal Protection Coefficient (NPC) and Effective Protection Coefficient (EPC) outcomes, that Basmati production was being taxed in the year 2017–2018, while IRRI production was supported in the country in both harvesting years. From the Net Private Profitability (NPP) and Net Social Profitability (NSP) outcomes, the fact was further strengthened that Punjab has a comparative advantage only in Basmati production, while IRRI paddy should only be produced in Sindh for export purposes. The study suggests that the comparative advantage of Basmati and IRRI paddy can be enhanced by augmenting yield and export parity prices, while production of IRRI paddy in Punjab should be discouraged and resources should be reallocated in the next efficient enterprises. Moreover, the public and private sectors should work together to minimize the major costs, especially the costs of fertilizers and pesticides.

Keywords: Basmati and IRRI Export, Policy Analysis Matrix, comparative advantage, SBC, DRC
JEL: F13, N10, N50, O13, Q17, Q18

1. Introduction

Rice is an important cereal crop worldwide. Approximately 85 percent of rice produced globally is utilized for consumption purposes, making it the highest edible ratio as compared to wheat and other important crops. Additionally, rice is the source of earning a wage for one fifth of the population of the world (Khan and Deshmukh, 2017). Pakistani Basmati rice is known worldwide for its peculiar aroma and taste, along with the ability to expand its volume twice while soaked. Rice is the second most important staple and cash crop in Pakistan after wheat and it plays an important role in the economy of the country. Approximately 3 million tons of rice is consumed domestically, and 4 million tons is exported annually. Pakistan was ranked 4th as a major rice exporter in the world in 2017 with an 8.40 percent share in the global market (FAO, 2018).

The main varieties of rice grown in Pakistan are Basmati, IRRI and Bold Grain. Basmati as a name indicates an aromatic, long grained variety of rice cultivated in Punjab (both Indian and Pakistani Punjab). The naturally endowed environmental conditions along with its genetic capabilities give these regions a natural comparative advantage in Basmati production. The IRRI variety was introduced in the 1960s in Punjab and Sindh to overcome the problems of food shortage in the country, and successfully achieved rice self-sufficiency over the years. Through better irrigation and modern farming techniques, rice production increased to 7.50 million tons in the year 2018 (GoP, 2018).

With changing trade patterns in the world under WTO terms and conditions, both developed and developing countries are supposed to reduce protection in agriculture, resulting in an efficient allocation of resources and encouraging trade based on a comparative advantage. Pakistan being an active member of the Agreement on Agriculture (AoA), will have to reduce support to its major agricultural commodities, hence enabling them to compete globally under diversified trade patterns. This study is a small effort to reinforce the fact that productivity of agricultural goods based on a comparative advantage, results in better resource allocation, lower production cost and higher returns, ensuring economic growth and development. The Policy Analysis Matrix (PAM) approach is of major importance in finding out the comparative advantage, pattern and direction of economic policies and develop competitiveness by using proper policy incentives (Pearson et.al., 1987; Monke and Pearson, 1989; Nelson and Panggabean 1994; Masters and Winter-Nelson, 1995; Khan, 1997; Ali and Khan, 2012, Koukao, 2015; Martinez, Tadeo and Estruch., 2018). This study used the Policy Analysis Matrix

(PAM) approach to evaluate comparative advantage and the effect of government policies on paddy rice production in Pakistan.

1.1. Specific Objectives of the Study

The specific objectives of the study were to:
(a) Determine comparative advantage and competitiveness of paddy rice production in Pakistan;
(b) Assess policy effects on paddy rice production for export purposes;
(c) Gauge government intervention in the Pakistan paddy rice sector and forward recommendations for improvement in the farmers' income, trade, and policy options.

1.2. Limitations of the Study

The Policy Analysis Matrix (PAM) is a static representation of farm productivity and the policy effects. Hence, the PAM framework fails to provide elasticities to facilitate decision-making for policy makers. However, the limitation can be overcome by conducting sensitivity analyses for major variables. Moreover, the present study focused only on the Pakistan Rice sector, whereas there is a need to carry out such studies for the overall agriculture system of society for timely decision-making and designing correct agricultural policies for the economy.

2. Materials and Methods

This study considered two major rice cultivating regions of Pakistan, namely Punjab and Sindh, and two famous rice varieties produced in these regions, Basmati and IRRI. The data, regarding costs and returns of Basmati and IRRI paddy was collected from Agriculture Policy Institute for the harvesting years, 2013–2014 and 2017–2018.

2.1. Analytical Framework

The Policy Analysis Matrix (PAM) was introduced by Monke and Pearson (1989) and modified by Master and Winter Nelson (1995). The framework is basically

used to evaluate comparative advantage, competitiveness, and the role of government intervention in agricultural production systems. The PAM, which is the second-best method used worldwide by economists, facilitates to evaluate a correct pattern of comparative advantage from the complex real world by estimating the interaction of agricultural activities, farm and macroeconomic policies and domestic and foreign prices, as the traditional comparative advantage lacks the ability to measure a true comparative advantage and related policy effects.

The Policy Analysis Matrix (PAM) is used to measure the comparative advantage, competitiveness and the role of government policies in Basmati and IRRI paddy production in the country. The PAM, which is a matrix of costs and revenues, consist of two accounting identities. The first identity comprises the last row of the matrix which shows that profit measured either in private or social opportunity cost terms is equal to revenue minus cost. The second identity is represented by the last column of the matrix which measures the policy effects as the difference between observed and efficiency values.

Table 1: Structure of the Policy Analysis Matrix (PAM)

Budget Items	Private Budget at Market Prices	National Budget at National Opportunity Cost	Effect of Policy (Divergence)
Revenue	A	F	K^c
Labor Costs	B	G	L^d
Capital Costs	C	H	M^c
Tradable Input Costs	D	I	N^f
Profit	E^a	J^b	O^g

Source: Adopted from Khan 1997, unpublished Ph.D. thesis, Department of Agricultural Economics, University of Kentucky, USA. pp. 1–49.

Where:

A = Total Revenue at Market Prices (P_m x Q)
B = Labor Cost at Market Prices (w_m x l)
C = Capital Cost at Market Prices (r_m x k)
D = Tradable Input Cost at Market Prices (P_m x Q)
E^a = Net Private Profitability [A-(B+C+D)]
F = Total Revenue at Social Prices (P_s x Q)
G = Labor Cost at Social Prices (w_s x l)
H = Capital Cost at Social Prices (r_s x k)
I = Tradable Input Cost at Social Prices (P_s x Q)
J^b = Net Social Profitability [F-(G+H+I)]

K^c = Output Transfer (A-F)
L^d = Labor Market Distortions (B-G)
M^e = Capital Market Distortions (C-H)
N^f = Other Input Transfers (D-I)
O^g = Total Policy Effects [E-J = K - (L+M+N) = NNP –NSP = PSE_{Total}]
P_m = Market Price of Output
Q = Quantity of Output
w_m = Wage Rate at Market Price
l = Labor
k = Capital
r_m = Interest Rate at Market Price
P_s = Social Price of Output
w_s = Wage Rate at Social Price
r_s = Interest Rate at Social Price

The PAM facilitates to generate the measures of comparative advantage (DRC and SBC ratios) and that of policy effects (NPC and EPC ratios), which helps in making comparisons among different commodities. These measures are free of measurement units which makes comparisons among commodities convenient.

1. Domestic Resource Cost Ratio	(DRC)	=	(G+H) / (F-I)
2. Social Benefit Cost Ratio	(SBC)	=	F / (G+H+I)
3. Nominal Protection Coefficient	(NPC)	=	A / F
4. Effective Protection Coefficient	(EPC)	=	(A-D) / (F-I)

2.2. Domestic Resource Cost (DRC) and Social Benefit Cost (SBC) Ratio

In the PAM framework, DRC = (G+H) / (F-I). G and H are domestic inputs (land, labor, and capital), F is revenue, while I shows cost of tradable input used. A DRC value greater than one indicates an inefficiency of a country in producing a particular commodity. On the other hand, if a DRC value is less than one it shows a comparative advantage in the production of a commodity.

The SBC = F/ (G+H+I), where F is revenue, while G, H, I represents costs of non-tradable and tradable inputs valued at social prices. An SBC ratio greater than one indicates that a country is an efficient producer of a commodity, while if an SBC ratio is less than one it means that the production of a commodity is not profitable for the country.

2.3. Nominal Protection Coefficient (NPC) and Effective Protection Coefficient (EPC)

Similar to efficiency, the components of policy analysis can be measured directly from the components of the PAM. The Nominal Protection Coefficient is one of the components of PAM, the ratio of domestic to border prices of a product. Using elements of Table 1, NPC = A / F, where A is domestic, while F is border price of a commodity. An NPC value greater than one indicates a country's inefficiency in the production of a particular commodity and whether prices have been tremendously affected by government policies and other factors, while if an NPC value is less than one, it indicates that production is taxed due to market failure or involvement of the government.

The Effective Protection Coefficient is considered a superior measure of incentives than the Nominal Protection Coefficient. In the Policy Analysis Matrix framework, EPC = (A-D) / (F-I) where A is revenue and D is tradable input costs at market prices, while F represents revenue and I shows tradable input cost valued at border prices. An EPC value exceeding unity is an indication of protection to the domestic producer, while an EPC value of less than one is the indicator of disincentives to the producer of a product. An EPC equal to one shows that producers are neither protected nor taxed. If an EPC is below zero it will indicate i) the social prices value added is negative ii) the value added in domestic prices is negative. The first condition shows that the economy is having losses and losing foreign exchange by producing a particular commodity, while the second case shows that producer is unable to remain in the business anymore until the government provides subsidy to the producers.

3. Results and Discussion

3.1. Estimation of PAM Budgets and Underlying Assumptions

The Policy Analysis Matrix (PAM) is a double entry bookkeeping identity. One identity shows profitability as the difference between revenue and costs, while the other measures the policy effects as the difference between observed values and values at opportunity cost. The peculiar structure of the Policy Analysis Matrix (PAM) gives a detailed explanation of complex relationships between variables.

As given in the tables of Appendix B, the first two columns of the PAM budget contain budget items and their total values at market price. The value of tradable inputs is estimated from column two based on the proportion of tradable inputs presented in the third column of the PAM budgets. The fourth and fifth columns contain the market values of budget items and opportunity cost values of inputs and outputs of budget items that are obtained by multiplying tradable inputs in column three with the foreign exchange premium of 3 percent for the year 2013–2014 and with the foreign exchange premium of 6 percent for the year 2017–2018. Any transfer of resources due to government interventions is presented in the last column of the PAM budgets.

3.1.1. Output

The top two rows of the PAM budgets in the tables of Appendix B present the paddy rice values first at market prices and then at national opportunity cost values. The market price of paddy rice is the wholesale price per 40 kg. The total revenue of paddy rice at market price is yield multiplied by paddy rice price per 40 kg per acre. The total revenue at national opportunity cost values are calculated by multiplying the paddy rice yield per acre by export parity price and the foreign exchange premium.

3.1.2. Labor

In the PAM budgets, labor is listed after output. The opportunity cost of labor is the marginal value product of labor, that is also the shadow price of labor foregone while it is employed in the production of paddy rice. The shadow price of labor will be presented by wage in a perfectly competitive economy. By adding non-tradable elements of tradable inputs, indirect labor cost is estimated.

3.1.3. Capital

Capital is the next item after output and labor in the PAM budget. In the PAM perspective, capital includes land rental values, markup and other capital inputs used indirectly in the production of paddy rice. The land rental value is the market price of land. The return of land in the best alternative use is the opportunity cost (shadow price) of land. The indirect capital cost is estimated similar to labor after estimating tradable inputs and labor costs of intermediate inputs.

3.1.4. Tradables

Tradable inputs are the last item in the PAM budgets. Tradables are those inputs which can be traded in the international market and are used directly or indirectly in the production of agricultural commodities. The tradable input cost includes the tradable portion of inputs after excluding the non-tradable portion that is further divided to intermediate inputs labor and capital. The opportunity cost of tradable inputs is the product of tradable inputs and the foreign exchange premium of 3 percent for the year 2013–2014 and foreign exchange premium of 6 percent for the year 2017–2018.

3.2. Policy Analysis Matrix (PAM) Results

3.2.1. Net Private Profitability (NPP) of Basmati and IRRI Paddy

The difference between revenue and cost valued at market price is the Net Private Profitability that can be used interchangeably for competitiveness.

Table 2: Net Private Profitability (NPP) of Basmati and IRRI Paddy (2013–2014 and 2017–2018) (Rs/Acre)

Country/ Province	Export Promotion Regime			
	Basmati		IRRI	
	2013–2014	***2017–2018***	***2013–2014***	***2017–2018***
Pakistan	21827.15	11120.60	8807.07	11632.96
Punjab	21827.15	11120.60	-1120.89	29.50
Sindh	--	--	10554.62	17514.40

Source: Author's calculation from the PAM Budgets in the Appendix.
Note: Basmati is not cultivated in Sindh.

Table 2 reveals that the Net Private Profitability (NPP) of Basmati reduced in 2017–2018 as compared to 2013–2014, due to lower market prices of Basmati paddy and yield per acre in the later year. The Net Private Profitability for IRRI paddy was highest in Sindh in both years while lowest in Punjab in both harvesting years. The reason behind lower Profitability in Punjab was a lower yield per acre and high cost of production with respect to land rent, irrigation cost, seed and sowing cost and the cost of fertilizers.

3.2.2. Net Social Profitability (NSP) of Basmati and IRRI Paddy

The Net Social Profitability reflects the relative economic efficiency since output (F) and inputs (G+H+I) are valued at social prices. If the Net Social Profitability is positive, the nation has a comparative advantage in production of a commodity, while a negative Net Social Profitability specifies that country cannot produce without support from the government, and production of the commodity is not a valuable addition to the country's stock of commodities (Kanaka and Chinnaduari, 2013).

Table 3: Net Social Profitability (NSP) of Basmati and IRRI Paddy (2013–2014 and 2017–2018) (Rs/Acre)

Country/ Province	Export Promotion Regime			
	Basmati		IRRI	
	2013–2014	***2017–2018***	***2013–2014***	***2017–2018***
Pakistan	12458.34	48780.80	-2790.80	-1154.78
Punjab	12458.34	48780.80	-12939.45	-9430.62
Sindh	--	--	-734.71	1931.55

Source: Author's calculation from the PAM Budgets in the Appendix.
Note: Basmati is not cultivated in Sindh.

As given in Table 3, the Net Social Profitability for Basmati paddy in Punjab was Rs. 12458.34 and Rs. 48780.80 per acre in the year 2013–2014 and 2017–2018 respectively. The Net Social Profitability of IRRI paddy in Pakistan and Punjab was negative in both harvesting years. The negative Net Social Profitability indicates an inefficiency of these regions in production of IRRI paddy. In the years 2017–2018, the highest Net Social Profitability for IRRI paddy was observed in Sindh where it was Rs. 1931.55 per acre. The Net Social Profitability in Sindh was higher because of better yield in the province.

3.3. Measuring Comparative Advantage

3.3.1. Domestic Resource Cost (DRC) Analysis

The development of Domestic Resource Cost analysis by Bruno (1967) and Krueger in the 1960s provides a mechanism to see through market distortions and capture an exact picture of the comparative advantage. In the context of the PAM methodology, DRC = (G + H) / (F - I) is the ratio of costs of domestic inputs (labor and capital) to its tradable value added at social prices. There is an inverse relationship

between the DRC ratio and comparative advantage. A country has a comparative advantage in any activity if (NSP > 0; DRC < 1). On the other hand, if (NSP < 0; DRC > 1), it indicates that country is an inefficient producer of that commodity.

Table 4: Domestic Resource Cost of Basmati and IRRI Paddy (2013–2014 and 2017–2018)

Country/ Province	Export Promotion Regime			
	Basmati		IRRI	
	2013–2014	***2017–2018***	***2013–2014***	***2017–2018***
Pakistan	0.67	0.36	1.17	1.05
Punjab	0.67	0.36	2.23	1.53
Sindh	--	--	1.03	0.93

Source: Author's calculation from the PAM Budgets in the Appendix.
Note: Basmati is not cultivated in Sindh.

As given in Table 4, the DRC co-efficients for Basmati paddy were less than 1 for both harvesting years, indicating a comparative advantage of Basmati production in the country. The DRC of IRRI paddy for the country was exceeding unity except for Sindh in 2017–2018, clearly specifying the comparative disadvantage of the country and provinces in IRRI production, except for Sindh in the later year.

3.3.2. Social Benefit Cost (SBC) Analysis

The Social Benefit Costs (SBC) analysis, SBC = F / (G + H + I), in the PAM framework, is the ratio of the net social benefit to the social opportunity costs of resources utilized in the production process. There is a positive relationship between the SBC analysis and comparative advantage. A country is competent in the production of a commodity if the SBC ratio exceeds unity. Whereas the country has no comparative advantage if the SBC ratio is less than unity, and the scarce resources are not properly allocated/utilized.

Table 5. Social Benefit Cost of Basmati and IRRI paddy (2013–2014 and 2017–2018)

Country/ Province	Export Promotion Regime			
	Basmati		IRRI	
	2013–2014	***2017–2018***	***2013–2014***	***2017–2018***
Pakistan	1.28	2.06	0.9	0.96
Punjab	1.28	2.06	0.68	0.78
Sindh	--	--	0.98	1.05

Source: Author's calculation from the PAM Budgets in the Appendix.
Note: Basmati is not cultivated in Sindh.

Table 5 shows the outcomes of the Social Benefit Cost analyses for Basmati and IRRI production in Pakistan, Punjab, and Sindh in both harvesting years. The results support the DRC outcomes that Punjab has a comparative advantage in Basmati production in both years, while IRRI production is only advantageous in Sindh in the harvesting year 2017–2018.

3.4. The Indicators of Policy Effects

3.4.1. Nominal Protection Coefficient (NPC) Ratio

In the PAM framework, NPC = A / F, where A is the revenue at market prices and F is the revenue at social opportunity cost prices. The value of the NPC below unity implies that the commodity production is taxed. Alternatively, when the NPC value is greater than one, it indicates that the commodity production is supported through policies and the country is an inefficient producer of that commodity.

Table 6: Nominal Protection Coefficient of Basmati and IRRI Paddy (2013–2014 and 2017–2018)

Country/ Province	Export Promotion Regime			
	Basmati		IRRI	
	2013–2014	***2017–2018***	***2013–2014***	***2017–2018***
Pakistan	1.14	0.58	1.32	1.28
Punjab	1.14	0.58	1.37	1.23
Sindh	--	--	1.29	1.29

Source: Author's calculation from the PAM Budgets in the Appendix.
Note: Basmati is not cultivated in Sindh.

Table 6 shows the Nominal Protection Coefficient (NPC) of Basmati and IRRI paddy production for export promotion. The NPC values for Basmati paddy in Punjab specify that Basmati farmers were supported in the year 2013–2014, while they were taxed in the year 2017–2018. The NPC values of IRRI paddy in the years 2013–2014 and 2017–2018, were greater than one for Pakistan, Punjab and Sindh, which implies that farmers received more than the world reference prices and were supported in both harvesting years.

3.4.2. Effective Protection Coefficient (EPC) Ratio

An EPC value exceeding unity indicates support to the domestic farmers of the commodity, while an EPC value below unity shows negative incentives and that the domestic farmers are taxed.

Table 7: Effective Protection Coefficient of Basmati and IRRI Paddy (2013–2014 and 2017–2018)

Country/ Province	Export Promotion Regime			
	Basmati		IRRI	
	2013–2014	***2017–2018***	***2013–2014***	***2017–2018***
Pakistan	1.22	0.49	1.5	1.39
Punjab	1.22	0.49	2.03	1.48
Sindh	--	--	1.52	1.45

Source: Author's calculation from the PAM Budgets in the Appendix.
Note: Basmati is not cultivated in Sindh.

Table 7 depicts the results of the Effective Protection Coefficient (EPC) for Basmati and IRRI paddy. Like the NPC, the EPC values for Basmati paddy in Punjab indicate that farmers were supported in the year 2013–2014 and were taxed in the year 2017–2018. The IRRI paddy growers in Pakistan, Punjab, and Sindh enjoyed a positive support from the government in input and output markets in the years 2013–2014 and 2017–2018 respectively.

4. Conclusions and Recommendations

4.1. Conclusions

It is evident from PAM analyses that in the harvesting years 2013–2014 and 2017–2018, Basmati production was a profitable enterprise in Punjab. The production of IRRI paddy was not profitable in all farming regions in both years except Sindh, in 2017–2018. In the year 2013–2014, the Net Private Profitability (NPP) indicating competitiveness of Basmati was higher as compared to 2017–2018. In the years 2013–2014 and 2017–2018, the Net Private Profitability for IRRI paddy was the highest in Sindh, followed by Pakistan and Punjab. The DRC and SBC analyses clearly showed a comparative advantage of Pakistan and Punjab in the production of Basmati paddy, whereas Pakistan, Punjab and Sindh demonstrated a comparative disadvantage in the production of IRRI paddy, except for Sindh in 2017–2018. The study further demonstrated that Basmati production was profitable

in Punjab under an export promotion regime, however, Basmati farmers were discouraged through the implementation of taxes in the year 2017–2018. In the years 2013–2014, Sindh had a comparative disadvantage in the production of IRRI, while IRRI producers were supported in both harvesting years. Punjab had a comparative disadvantage in the production of IRRI in both harvesting years, even though the government had supported IRRI production in the province. The policy measures should be used to discourage the production of IRRI in Punjab so that precious resources are liberated and utilized in the most efficient alternative enterprise production in the province.

4.2. Recommendations

The most important recommendations based on the study are presented as follows:

(a) Punjab shows a comparative advantage in Basmati paddy production for export purpose, therefore policy makers must formulate policies which further strengthen production and trade of Basmati paddy in the region.
(b) Punjab has a comparative disadvantage in IRRI paddy production, the government should therefore discourage IRRI production in Punjab and utilize resources in the next best alternative.
(c) Furthermore, Sindh has comparative advantage in IRRI production for export purpose which might be enhanced by improving yield and use of modern methods of cultivation in addition to subsidizing IRRI production in Sindh.
(d) It was recommended that world level prices must be ensured to Basmati and IRRI growers for the encouragement of Basmati and IRRI production and trade.
(e) Moreover, the study further suggests providing farmers and other stake holders with updated and uninterrupted information regarding input and output prices, especially the knowledge about improved rice varieties. Agricultural and macroeconomic policies should be ensured to enhance competitiveness of Basmati and IRRI farmers.
(f) It is observed that Pakistan is facing a food policy crisis instead of a food shortage. Therefore, honest and sincere efforts on behalf of policy makers are required to make farm and trade policies, which are consistent with the true pattern of comparative advantage of the country, in order to ensure food self-sufficiency and availability of food at lower prices.

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APPENDICES

Appendix A

Table A.1: Economic Export Parity Price of Basmati Paddy on the Basis of the FOB (Karachi) Price (2013–2014)

Items	Values
Average Fob Karachi Price (US$/Tonne)	1079.00
Average Fob Karachi Price @ FXR Rs. 98.75/01 US $ (Rs./40 kg)	4262.00
Expenses from Sheller/Market to Export Point (Rs./40 kg)	225.00
Producer area Market Level Price of Rice (Rs./40 kg)	4037.00
Value of Products Recoverable from 100 kgs. Paddy	5708.00
Husking/Processing/Financial Charges	288.00
Export Parity Price of Paddy at Mill-gate (Rs./100 kg)	5420.00
Export Parity Price of Paddy at Mill-gate (Rs./40 kg)	2168.00
Export Parity Price of Paddy at Market level (Rs./40 kg)	2168.00
Marketing Expenses (Rs./40 Kg)	40.00
Export Parity Price at Farm level (Rs./40 Kg)	2128.00

Source: Price policy for Rice: 2014-15 Crop, Agriculture Prices Commission Government of Pakistan, Islamabad.

Table A.2: Economic Export Parity Price of the Basmati Paddy on the basis of the FOB (Karachi) Price (2017–2018)

Items	Values
Average Fob Karachi Price (US$/Tonne)	1105.84
Average Fob Karachi Price @ FXR Rs.132/01US $ (Rs. /40 kg)	5839.00
Expenses from Sheller/Market to Export Point (Rs./40 kg)	225.00
Producer area Market Level Price of Rice (Rs./40 kg)	5614.00
Value of Products Recoverable from 100 kgs. Paddy	7869.00
Husking/Processing/Financial Charges	288.00
Export Parity Price of Paddy at Mill-gate (Rs./100 kg)	7581.00
Export Parity Price of Paddy at Mill-gate (Rs./40 kg)	3032.00
Export Parity Price of Paddy at Miarket level (Rs./40 kg)	3032.00
Marketing Expenses (Rs./40 Kg)	50.00
Export Parity Price at Farm level (Rs./40 Kg)	2982.00

Source: Price policy for Rice: 2018-19 Crop, Agriculture Prices Commission Government of Pakistan, Islamabad.

Table A.3: Economic Export Parity Price of IRRI Paddy on the Basis of the FOB (Karachi) Price (2013–2014)

Items	Values
Average Fob Karachi Price (US$/Tonne)	468.00
Average Fob Karachi Price @ FXR Rs. 98.75/01 US$ (Rs./40 kg)	1849.00
Expenses from Sheller/Market to Export Point (Rs./40 kg)	125.00
Producer area Market Level Price of Rice (item 2-item 3) (Rs./40 kg)	1724.00
Value of Products Recoverable from 100 kg Paddy	2193.00
Husking/Processing/Financial Charges	288.00
Export Parity Price of Paddy at Mill-gate (Rs./100 kg)	1905.00
Export Parity Price of Paddy at Mill-gate (Rs./40 kg)	762.00
Export Parity Price of Paddy at Market level (Rs./40 kg)	762.00
Marketing Expenses (Rs./40 Kg)	40.00
Export Parity Price at Farm level (Rs./40 Kg)	722.00

Source: Price policy for Rice: 2014-15 Crop, Agriculture Prices Commission Government of Pakistan, Islamabad

Table A.4: Economic Export Parity Price of IRRI Paddy on the Basis of the FOB (Karachi) Price (2017–2018)

Items	Values
Average Fob Karachi Price (US$/Tonne)	362.00
Average Fob Karachi Price @ FXR Rs. 132/01 US $ (Rs./40 kg)	1909.00
Expenses from Sheller/Market to Export Point (Rs./40 kg)	125.00
Producer area Market Level Price of Rice (item 3-item 4) (Rs./40 kg)	1784.00
Value of Products Recoverable from 100 kgs. Paddy	2261.00
Husking/Processing/Financial Charges	288.00
Export Parity Price of Paddy at Mill-gate (Rs./100 kg)	1973.00
Export Parity Price of Paddy atMill-gate (Rs./40 kg)	789.00
Export Parity Price of Paddy at Market level (Rs./40 kg)	789.00
Marketing Expenses (Rs./40 Kg)	50.00
Export Parity Price at Farm level (Rs./40 Kg)	739.00

Source: Price Policy For Rice: 2018–2019 Crop, Agriculture Prices Commission Government of Pakistan, Islamabad.

Table A.5: Allocation of Costs between Traded and Non Traded Labor and Capital

Inputs	Total	Traded	Non-Traded	Labor	Capital
Product and By Products	100.00	100.00	0.00	0.00	0.00
Pre-Sowing Operation (With Tractor)	100.00	85.00	15.00	100.00	0.00
Seed and Sowing	100.00	87.00	13.00	50.00	50.00
Intercultural Practices	100.00	85.00	15.00	50.00	50.00
Irrigation (Canal)	100.00	50.00	50.00	100.00	0.00
Irrigation (Tube well)	100.00	75.00	25.00	100.00	0.00
Manures, Fertilizers and Chemicals	100.00	85.00	15.00	100.00	0.00
Land Revenue and Local Taxes	100.00	5.00	95.00	100.00	0.00
Harvesting & Threshing	100.00	5.00	95.00	100.00	0.00
Transport and Marketing	100.00	5.00	95.00	25.00	75.00

Sources: Institute of Development Studies report, The University of Agriculture Peshawar, Publication No.18.

Table A.6: Standard Conversion Factor and Shadow Exchange Rate

1. The shadow exchange rate, which is used to analyze the comparative advantage of any economic activity, is estimated with the help of the Standard Conversion Factor (SCF). Following the procedures from "Economic Analysis of Projects".
We define:

SCF = $X+M / (X-T_x) + (M+T_m)$

Where

X = Value of Exports
M = Value of Imports
T_x = Value of Taxes on Exports
T_m = Value of Taxes on Imports

2. Alternatively,

SER = OER / SCF
Where the OER is the official exchange rate and the SER is the shadow exchange rate. Once the standard conversion factor is derived, then

SER = OER / SCF
This approach was used in determining the shadow exchange rate.

Standard Conversion Factor and Shadow Exchange Rate (2013–2014).

			Rs. Million		
1.	Total Value of Exports		2583463.00		
2.	Total Value of Imports		4630521.00		
3.	Export Duties		476.00		
4.	Import Duties		235596.00		
5.	Official Exchange Rate	98.75			
SCF	**=**	**$X + M / (X - T_x) + (M + T_m)$**			
	=	7213984.00 / 7449104.00	= 0.97		
SCF	=	0.97			
SER	=	OER / SCF	= 98.75 / 0.97	=	101.97
Premium	**=**	**SER / OER**	**= 101.97 / 98.75**	**=**	**1.03**

Source: 1. Economic Survey of Pakistan 2013-2014
2. Yearbook 2017-2018, Federal Bureau of Revenue and Statistics.

Thus, the outcome specifies that the rupee was appreciated (the dollar was underpriced against the rupee) by about 3 percent in 2013–2014.

Standard Conversion Factor and Shadow Exchange Rate (2017–2018).

			Rs. Million
1.	Total Value of Exports		2555043.00
2.	Total Value of Imports		6694897.00
3.	Export Duties		859.00
4.	Import Duties		538019.00
5.	Official Exchange Rate	1	32.00

SCF = $\mathbf{X + M / (X - T_x) + (M + T_m)}$

= 9249940.00 / 9787100.00 = 0.94

SCF = 0.94

SER = OER / SCF = 132.00 / 0.94 = 139.67

Premium = SER / OER = 139.67 / 132.00 = 1.06

Source: 1. Economic Survey of Pakistan 2018–2019
2. Yearbook 2017–2018, Federal Bureau of Revenue and Statistics.

Thus, the outcome shows that the rupee was appreciated (the dollar was underpriced against the rupee) by about 6 percent in 2017–2018.

Appendix B

Table B.1: PAM Budget for the Basmati Paddy Harvesting Year 2013–2014 for Punjab (Export Promotion Regime) Rs/Acre

Item	Total Value	Percent Tradable	Market Value	Opportunity Cost Value FEP* 3% Tradable	Transfer
Product & Byproducts	65494.50	65494.50	65494.50		
Export Parity (2013-14)	56019.60	56019.60	56019.60	57700.19	7794.31
Labor	12341.55	0.00	12341.55	12341.55	0.00
Management	1030.00	0.00	1030.00	1030.00	0.00
Labor for Bund making	344.40	0.00	344.40	344.40	0.00
Manual Weeding	403.90	0.00	403.90	403.90	0.00
Labor for Irrigation & Water Course Cleaning	2140.47	0.00	2140.47	2140.47	0.00
Indirect (Input)	8422.78	0.00	8422.78	8422.78	0.00
Capital	12175.80	0.00	12175.80	13175.80	-1000.00
Land Rent Value	9500.00	0.00	9500.00	10500.00	-1000.00
Mark Up	1564.69	0.00	1564.69	1564.69	0.00
Indirect (Input)	1111.11	0.00	1111.11	1111.11	0.00
Tradables	28683.89	19150.00	19150.00	19724.50	-574.50
Land Preparation	5150.00	4377.50	4377.50	4508.83	-131.33
Seed & Sowing Operations	3485.00	3031.95	3031.95	3122.91	-90.96
Intercultural Practices	712.75	605.84	605.84	624.01	-18.18
Irrigation (Canal)	85.00	42.50	42.50	43.78	-1.28
Irrigation (Tube Well)	8529.03	6396.77	6396.77	6588.68	-191.90
Fertilizers & FYM	5199.17	4419.29	4419.29	4551.87	-132.58
Land Revenue & Local Taxes	71.00	3.55	3.55	3.66	-0.11
Harvesting & Threshing	4285.44	214.27	214.27	220.70	-6.43
Transport & Marketing	1166.50	58.33	58.33	60.07	-1.75
Profitability			21827.15	12458.34	9368.81
DRC	0.67				
SBC	1.28				
NPC	1.14				
EPC	1.22				
Yield (40kg/ Acre)	26.33				
Wholesale Price of Basmati Paddy (Rs./40 Kg)	2260.00				
Total Value of Production at Market Price	59494.50				
Value of Paddy Straw (By-Product)	6000.00				
Gross Value of Output	65494.50				
Export Parity Price of Paddy at Farm Level (Rs./40Kg)	2128.00				
Total Value of Export Parity Price	56019.60				

FEP* = Foreign Exchange Premium

Table B.2: PAM Budget for the Basmati Paddy Harvesting Year 2017–2018 for Punjab (Export Promotion Regime) Rs/Acre

Item	Total Value	Percent Tradable	Market Value	Opportunity Cost Value FEP* 6% Tradable	Transfer
Product & Byproducts	55120.00	55120.00	55120.00		
Export Parity (2017-18)	89460.00	89460.00	89460.00	94827.60	-39707.60
Labor	11645.64	0.00	11645.64	11645.64	0.00
Management	1563.00	0.00	1563.00	1563.00	0.00
Labor for Bund Making	442.80	0.00	442.80	442.80	0.00
Manual Weeding	460.00	0.00	460.00	460.00	0.00
Labor for Irrigation & Water Course Cleaning	2752.00	0.00	2752.00	2752.00	0.00
Indirect (In Input)	6427.84	0.00	6427.84	6427.84	0.00
Capital	14897.86	0.00	14897.86	15897.86	-1000.00
Land Rent Value	11500.00	0.00	11500.00	12500.00	-1000.00
Mark Up	1732.00	0.00	1732.00	1732.00	0.00
Indirect (Input)	1665.86	0.00	1665.86	1665.86	0.00
Tradables	25549.62	17455.92	17455.92	18503.27	-1047.35
Land Preparation	3962.00	3367.7	3367.70	3569.76	-202.06
Seed & Sowing Operation	5577.00	4852	4851.99	5143.11	-291.12
Intercultural Practices	534.60	454.41	454.41	481.67	-27.26
Irrigation (Canal)	95.72	47.86	47.86	50.73	-2.87
Irrigation (Tube Well)	6241.00	4680.8	4680.75	4961.60	-280.85
Fertilizers & FYM	4495.30	3821	3821.01	4050.27	-229.26
Land Revenue & Local Taxes	71.00	3.55	3.55	3.76	-0.21
Harvesting & Threshing	2800.00	140.00	140.00	148.40	-8.40
Transport & Marketing	1773.00	88.65	88.65	93.97	-5.32
Profitability			11120.60	48780.80	-37660.20
DRC	0.36				
SBC	2.06				
NPC	0.58				
EPC	0.49				
Yield (40 kg/ Acre)	30.00				
Wholesale Market Price of Basmati Paddy (Rs./40Kg)	1604.00				
Total Value of Production at Market Price	48120.00				
Value of Paddy Straw (By-Product)	7000.00				
Gross Value of Output	55120.00				
Export Parity Price of Paddy at Farm Level (Rs./40 Kg)	2982.00				
Total Value of Export Parity Price	89460.00				

FEP* = Foreign Exchange Premium

Table B.3: PAM Budget for the IRRI Paddy Harvesting Year 2013–2014 for Pakistan

Items	Total Value	Percent Tradable	Market Value	Opportunity Cost Value FEP* 3% Tradable	Transfer
Product & Byproducts	33326.01	33326.01	33326.01		
Export Parity (2013–2014)	24549.31	24549.31	24549.31	25285.79	8040.22
Labor	7189.89	0.00	7189.89	7189.89	0.00
Management	797.22	0.00	797.22	797.22	0.00
Labor for Bund Making	364.55	0.00	364.55	364.55	0.00
Manual Weeding	439.83	0.00	439.83	439.83	0.00
Labor for Irrigation & Water Course Cleaning	1196.93	0.00	1196.93	1196.93	0.00
Indirect (Input)	4391.35	0.00	4391.35	4391.35	0.00
Capital	8743.82	0.00	8743.82	12043.92	-3300.10
Land Rent Value	6549	0.00	6549.00	9849.10	-3300.10
Mark Up	1011.18	0.00	1011.18	1011.18	0.00
Indirect (Input)	1183.64	0.00	1183.64	1183.64	0.00
Tradables	14160.22	8585.23	8585.23	8842.79	-257.56
Land Preparation	3004.08	2553.47	2553.47	2630.08	-76.60
Seed & Sowing Operation	2215.97	318.22	1927.89	1985.73	-57.84
Intercultural Practices	180.32	153.27	153.27	157.87	-4.60
Irrigation (Canal)	52.60	26.30	26.299345	27.09	-0.79
Irrigation (Tube Well)	783.10	587.33	587.325	604.94	-17.62
Fertilizers & FYM	3675.95	3124.56	3124.56	3218.30	-93.74
Land Revenue & Local Taxes	73.18	3.66	3.66	3.77	-0.11
Harvesting & Threshing	2734.91	136.75	136.75	140.85	-4.10
Transport & Marketing	1440.11	72.01	72.01	74.17	-2.16
Profitability			8807.07	-2790.80	11597.88
DRC	1.17				
SBC	0.90				
NPC	1.32				
EPC	1.50				
Yield (40Kg/Acre)	43.93				
Wholesale Market Price of IRRI Paddy (Rs/40Kg)	696.95				
Total Value of Production at Market Price (Rs./40kg)	30617.01				
Value of Paddy Straw (By-Product)	2709.00				
Gross Value of Output	33326.01				
Export Parity Price of Paddy at Farm Level (Rs/40Kg)	558.83				
Total value at Export Parity Price	24549.31				

(Export Promotion Regime) Rs/Acre
FEP* = Foreign Exchange Premium

Table B.4: PAM Budget for the IRRI Paddy Harvesting Year 2013–2014 for Punjab (Export Promotion Regime) Rs/Acre

Item	Total Value	Percent Tradable	Market Value	Opportunity Cost Value FEP* 3% Tradable	Transfer
Product & Byproducts	38381.00	38381.00	38381.00		
Export Parity (2013–2014)	27255.50	27255.50	27255.50	28073.17	10307.84
Labor	10103.36	0.00	10103.36	10103.36	0.00
Management	1030.00	0.00	1030.00	1030.00	0.00
Labor for Bund Making	402.50	0.00	402.50	402.50	0.00
Manual Weeding	468.30	0.00	468.3	468.3	0.00
Labor for Irrigation & Water Course Cleaning	2087.40	0.00	2087.40	2087.40	0.00
Indirect (Input)	6115.16	0.00	6115.16	6115.16	0.00
Capital	12374.47	0.00	12374.47	13374.47	-1000.00
Land Rent Value	9500.00	0.00	9500.00	10500.00	-1000.00
Mark Up	1396.99	0.00	1396.99	1396.99	0.00
Indirect (Input)	1477.48	0.00	1477.48	1477.48	0.00
Tradables	24616.7	17024.05	17024.05	17534.77	-510.72
Land Preparation	4725.00	4016.25	4016.25	4136.74	-120.49
Seed & Sowing Operation	3325.00	2892.75	2892.75	2979.53	-86.78
Intercultural Practices	888.05	754.8425	754.84	777.49	-22.65
Irrigation (Canal)	85.00	42.5	42.5	43.78	-1.28
Irrigation (Tube Well)	4380.68	3285.51	3285.51	3384.08	-98.57
Fertilizers & FYM	6839.44	5813.524	5813.52	5987.93	-174.41
Land Revenue & Local Taxes	71.00	3.55	3.55	3.66	-0.11
Harvesting & Threshing	2625.68	131.284	131.28	135.22	-3.94
Transport & Marketing	1676.85	83.8425	83.84	86.36	-2.52
Profitability			-1120.89	-12939.45	11818.56
DRC	2.23				
SBC	0.68				
NPC	1.37				
EPC	2.03				
Yield (40 Kg/Acre)	37.75				
Wholesale Market Price of IRRI Paddy (Rs./40 Kg)	924.00				
Total Value of Production at Market Price (Rs./40kg)	34881.00				
Value of Paddy Straw (By-Product)	3500.00				
Gross Value of Output	38381.00				
Export Parity Price of Paddy at Farm Level (Rs./40Kg)	722.00				
Total Value at Export Parity Price	27255.50				

FEP* = Foreign Exchange Premium

Table B.5: PAM Budget for the IRRI Paddy Harvesting Year 2013–2014 for Sindh (Export Promotion Regime) Rs/Acre

Item	Total Value	Percent Tradable	Market Value	Opportunity Cost Value FEP* 3% Tradable	Transfer
Product & Byproducts	48089.00	48089.00	48089.00		
Export Parity (2013-14)	36172.20	36172.20	36172.20	37257.37	10831.63
Labor	11189.24	0.00	11189.24	11189.24	0.00
Management	1030.00	0.00	1030.00	1030.00	0.00
Labor for Bund Making	700.00	0.00	700.00	700.00	0.00
Manual Weeding	852.25	0.00	852.25	852.25	0.00
Labor for Irrigation & Water Course Cleaning	1958.14	0.00	1958.14	1958.14	0.00
Indirect (Input)	6648.85	0.00	6648.85	6648.85	0.00
Capital	11088.55	0.00	11088.55	11088.55	0.00
Land Rent Value	8000.00	0.00	8000.00	8000.00	0.00
Mark Up	1266.23	0.00	1266.23	1266.23	0.00
Indirect (Input)	1822.32	0.00	1822.32	1822.32	0.00
Tradables	23727.76	15256.59	15256.59	15714.28	-457.70
Land Preparation	6350.00	5397.50	5397.50	5559.43	-161.93
Seed & Sowing Operation	4240.00	3688.80	3688.80	3799.46	-110.66
Intercultural Practices	452.55	384.67	384.67	396.21	-11.54
Irrigation (Canal)	88.78	44.39	44.39	45.72	-1.33
Irrigation (Tube Well)	339.30	254.48	254.48	262.11	-7.63
Fertilizers & FYM	6092.37	5178.51	5178.51	5333.87	-155.36
Land Revenue & Local Taxes	105.00	5.25	5.25	5.41	-0.16
Harvesting & Threshing	3936.56	196.83	196.83	202.73	-5.90
Transport & Marketing	2123.20	106.16	106.16	109.34	-3.18
Profitability			10554.62	-734.71	11289.33
DRC	1.03				
SBC	0.98				
NPC	1.29				
EPC	1.52				
Yield (40Kg/Acre)	50.10				
Wholesale Market Price of IRRI Paddy (Rs./40 Kg)	890.00				
Total Value of Production at Market Price (Rs./40kg)	44589.00				
Value of Paddy Straw (By-Product)	3500.00				
Gross Value of Output	48089.00				
Export Parity Price Of Paddy at Farm Level (Rs./40Kg)	722.00				
Total value at Export Parity Price	36172.20				

FEP* = Foreign Exchange Premium

Table B.6: PAM Budget for the IRRI Paddy Harvesting Year 2017–2018 for Pakistan (Export Promotion Regime) Rs/Acre

Item	Total Value	Percent Tradable	Market Value	Opportunity Cost Value	Transfer
Product And Byproduct	36080.80	36080.80	36080.80		
Export Parity (2017-18)	26695.45	26695.45	26695.45	28297.18	7783.62
Labor	7013.69	0.00	7013.69	7013.69	0.00
Management	1158.18	0.00	1158.18	1158.18	0.00
Labor for Bund Making	401.02	0.00	401.02	401.02	0.00
Manual Weeding	462.59	0.00	462.59	462.59	0.00
Labor for Irrigation & Water Course Cleaning	1295.36	0.00	1295.36	1295.36	0.00
Indirect (Input)	3696.54	0.00	3696.54	3696.54	0.00
Capital	10640.39	0.00	10640.39	15236.89	-4596.50
Land Rent Value	7717.50	0.00	7717.50	12314.00	-4596.50
Mark Up	1377.10	0.00	1377.10	1377.10	0.00
Indirect (Input)	1545.79	0.00	1545.79	1545.79	0.00
Tradables	12036.08	6793.75	6793.75	7201.38	-407.63
Land Preparation	1987.40	1689.29	1689.29	1790.65	-101.36
Seed & Sowing Operations	2407.87	2094.85	2094.85	2220.54	-125.69
Intercultural Practices	246.96	209.92	209.92	222.51	-12.59
Irrigation (Canal)	38.04	19.02	19.02	20.16	-1.14
Irrigation (Tube Well)	660.82	495.62	495.62	525.35	-29.74
Fertilizers & FYM	2437.89	2072.21	2072.21	2196.54	-124.33
Land Revenue & Local Taxes	44.04	2.20	2.20	2.33	-0.13
Harvesting & Threshing	2289.20	114.46	114.46	121.33	-6.87
Transport & Marketing	1923.87	96.19	96.19	101.97	-5.77
Profitability			11632.96	-1154.78	12787.75
DRC	1.05				
SBC	0.96				
NPC	1.28				
EPC	1.39				
Yield (40 Kgs/Acre)	48.75	1950.00			
Wholesale Market Price of IRRI Paddy (Rs. /40 Kg)	644.71				
Total Value of Irri Production at Market Price (Rs. /40kg)	31429.76				
Value of Paddy Straw (By-Product)	4651.00				
Gross Value of Production	36080.76	36080.76			
Export Parity Price of Paddy at Farm Level (Rs. /40Kg)	547.60				
Total Value at Export Parity Price	26695.45				

FEP* = Foreign Exchange Premium

Table B.7: PAM Budget for the IRRI Paddy Harvesting Year 2017–2018 for Punjab (Export Promotion Regime) Rs/Acre

Item	Total Value	Percent Tradable	Market Value	Opportunity Cost Value FEP* 6% Tradable	Transfer
Product & Byproducts	40872.50	40872.50	40872.50		
Export Parity (2017-18)	31407.50	31407.50	31407.50	33291.95	7580.55
Labor	11120.63	0.00	11120.63	11120.63	0.00
Management	1563.00	0.00	1563.00	1563.00	0.00
Labor for Bund Making	517.50	0.00	517.50	517.50	0.00
Manual Weeding	535.20	0.00	535.20	535.20	0.00
Labor for Irrigation and Water Course Cleaning	2683.80	0.00	2683.80	2683.80	0.00
Indirect (Input)	5821.13	0.00	5821.13	5821.13	0.00
Capital	15062.91	0.00	15062.91	16062.91	-1000.00
Land Rent Value	11500.00	0.00	11500.00	12500.00	-1000.00
Mark Up	1484.30	0.00	1484.30	1484.30	0.00
Indirect (Input)	2078.61	0.00	2078.61	2078.61	0.00
Tradables	22559.20	14659.47	14659.47	15539.04	-879.57
Land Preparation	3962.00	3367.70	3367.70	3569.76	-202.06
Seed & Sowing Operation	4583.10	3987.30	3987.30	4226.53	-239.24
Intercultural Practices	702.40	597.04	597.04	632.86	-35.82
Irrigation (Canal)	95.70	47.85	47.85	50.72	-2.87
Irrigation (Tube Well)	3369.80	2527.35	2527.35	2678.99	-151.64
Fertilizers & FYM	4549.90	3867.42	3867.42	4099.46	-232.04
Land Revenue & Local Taxes	71.00	3.55	3.55	3.76	-0.21
Harvesting & Threshing	2800.00	140.00	140.00	148.40	-8.40
Transport & Marketing	2425.30	121.27	121.27	128.54	-7.28
Profitability			29.50	-9430.62	9460.12
DRC	1.53				
SBC	0.78				
NPC	1.23				
EPC	1.48				
Yield (40 Kg/Acre)	42.50				
Wholesale Market Price Of IRRI Paddy (Rs./40 Kg)	797.00				
Total Value of Production at Market Price (Rs./40kg)	33872.50				
Value of Paddy Straw (By-Product)	7000.00				
Gross Value of Production	40872.50				
Export Parity Price of Paddy at Farm Level (Rs./40Kg)	739.00				
Total Value At Export Parity Price	31407.50				

FEP* = Foreign Exchange Premium

Table B.8: PAM Budget for the IRRI Paddy Harvesting Year 2017-18 for Sindh

Item	Total Value	Percent Tradable	Market Value	Opportunity Cost Value FEP* 6% Tradable	Transfer
Product & Byproducts	55390.00	55390.00	55390.00		
Export Parity (2017–2018)	40645.00	40645.00	40645.00	43083.70	12306.30
Labor	11252.03	0.00	11252.03	11252.03	0.00
Management	1563.00	0.00	1563.00	1563.00	0.00
Labor for Bund Making	800.00	0.00	800.00	800.00	0.00
Manual Weeding	974.00	0.00	974.00	974.00	0.00
Labor for Irrigation & Water Course Cleaning	2238.00	0.00	2238.00	2238.00	0.00
Indirect (Input)	5677.03	0.00	5677.03	5677.03	0.00
Capital	13681.00	0.00	13681.00	16181.00	-2500.00
Land Rent Value	10000.00	0.00	10000.00	12500.00	-2500.00
Mark Up	1269.90	0.00	1269.90	1269.90	0.00
Indirect (Input)	2411.10	0.00	2411.10	2411.10	0.00
Tradables	21030.70	12942.57	12942.57	13719.12	-776.55
Land Preparation	5163.00	4388.55	4388.55	4651.86	-263.31
Seed & Sowing Operation	4500.00	3915.00	3915.00	4149.90	-234.90
Intercultural Practices	378.80	321.98	321.98	341.30	-19.32
Irrigation (Canal)	95.70	47.85	47.85	50.72	-2.87
Irrigation (Tube Well)	391.50	293.63	293.63	311.24	-17.62
Fertilizers & FYM	4313.10	3666.14	3666.14	3886.10	-219.97
Land Revenue & Local Taxes	55.00	2.75	2.75	2.92	-0.17
Harvesting & Threshing	3200.00	160.00	160.00	169.60	-9.60
Transport & Marketing	2933.60	146.68	146.68	155.48	-8.80
Profitability			17514.40	1931.55	15582.85
DRC	0.93				
SBC	1.05				
NPC	1.29				
EPC	1.45				
Yield (40 Kg/Acre)	55.00				
Wholesale Market Price of IRRI Paddy (Rs./40 Kg)	898.00				
Total Value of Production at Market Price (Rs./40kg)	49390.00				
Value of Paddy Straw (By-Product)	6000.00				
Gross Value of Output	55390.00				
Export Parity Price of Paddy at Farm Level (Rs./40Kg)	739.00				
Total Value at Export Parity Price	40645.00				

(Export Promotion Regime) Rs/Acre
FEP* = Foreign Exchange Premium