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Promoting Innovation Performance in European Developing Nations: Role of Technology Transfer, Regulation Quality, Research and Development Expenditures, and Knowledge Spillovers

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ABSTRACT

The European Union's single market has positioned it as a key player in global foreign direct investment (FDI). Nevertheless, the more developed economies of the original 15 EU member states have consistently drawn a larger portion of inbound FDI. This study explores the relationship between FDI, technology transfer, and innovation performance in 26 EU member states. It also considers the influence of human capital, R&D, and anti-corruption policies on FDI and innovation. Using panel data from 2011 to 2022 and fixed effect estimation (FEE) techniques, the research investigates how FDI-induced spillovers impact patent activities in both the advanced economies of the EU-15 and the transition economies of Central and Eastern European Countries (CEEC). The findings reveal that FDI generally boosts innovation performance in EU enterprises, with a more pronounced effect on the innovation activities of CEEC countries, reflecting their efforts to enhance their innovation capabilities. However, industry-level analysis indicates that EU-15 manufacturing sectors are more likely to benefit from FDI than their counterparts in the CEEC. The study offers valuable insights into the role of regulation quality, technology transfer, human capital, R&D investments, and FDI in driving innovation and economic growth in host countries.

Keywords: Technology Transfer; Foreign Direct Investment; Innovation; Human Capital; Regulation Quality

1. INTRODUCTION

Investment from foreign countries helps economies grow, allowing developing countries to learn about and adopt cutting-edge technologies from more wealthy

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countries. Increased tax revenue results from a higher standard of living, which in turn increases the number of people able to work and contribute to society (Kim et al., 2023); and the number of people working and contributing to society. Spillover channels, such as the movement of technical labor and reverse engineering, are some ways in which this phenomenon influences the innovation process (Abbas & Khan, 2022). The transfer of technology fosters education and training in cutting-edge technologies, which advances human capital in the host country and paves the way for more incredible homegrown innovation (Chen et al., 2023).

Since FDI facilitates the transfer of technology from advanced to developing nations, some scholars, including Ahmad et al. (2020), consider it more significant than domestic investment. Consumers benefit more when goods are produced by companies based in more technologically sophisticated nations than those based in the host country (Najam et al., 2022). When MNCs enter a market, they increase domestic competition, which in turn encourages local businesses to become more competitive through increased efficiency in resource usage, enhanced customer service, and enhanced product quality (Wang et al., 2022). Knowledge, productivity, and export spillover occur in the host country (Tong et al., 2023) because foreign enterprises contribute sophisticated expertise and technological skills, eventually diffusing into the local economy (Yu et al., 2022).

The European Union (EU) has recently emerged as a key player in global FDI dynamics, strengthening its position as a major economic force (Tong et al., 2023). Historically, the bulk of incoming FDI has been directed toward the more developed economies of the EU's original 15 members, while newer members, particularly the Central and Eastern European Countries (CEEC), have attracted less attention. In an effort to enhance the innovation capabilities of domestic businesses and promote deeper economic integration between the CEEC and the EU, EU officials are implementing strategies to draw foreign investment to the CEEC region. However, it remains uncertain whether the impact of FDI on national innovation performance in the CEEC differs from or aligns with the effects seen in the EU-15.

Although there are several studies on FDI, economic growth, and intellectual property rights (IPR), most studies have only examined one country or region. Habib et al. (2019) analyzed the impact of human capital, IPR, and R&D spending on productivity growth in Brazil, Russia, India, and China (BRIC). Khadan (2018) looked into the impact of human capital on the region's creative output in the Caribbean. Using human capital as a moderating variable, Awan (2020) examined the effect of foreign direct investment and trade on knowledge spillover. Despite the increasing importance of CEEC to the global economy, the researchers could not find a reputable study that investigated FDI, technology transfer, and innovation performance in the context of CEEC and EU-15 and then compared the two regions.

To address this gap in knowledge, we utilize panel data from 2011 to 2022 to explore the relationship between foreign direct investment (FDI), technology transfer, and the innovation performance of the host country's manufacturing sector in both the CEEC and EU. The study analyzes firm patenting activities in the developed economies of the EU-15 and the transition economies of the CEEC to assess the impact of FDI-driven spillovers using the fixed effect estimation (FEE) method. Additionally, this research incorporates human capital, R\&D spending, and regulatory quality aimed at reducing corruption into the core framework of FDI and innovation. The CEEC region includes Bulgaria, Latvia, Poland, Croatia, Hungary, the Czech Republic, Slovakia, Romania, Slovenia, Lithuania, and Estonia, though Albania is excluded due to data limitations. The EU-15 comprises Belgium, Spain, Italy, Austria, Sweden, Denmark, Portugal, Greece, France, Ireland, and the Netherlands, with the United Kingdom, France, Germany, Ireland, the Netherlands, Finland, Luxembourg, and Sweden not being part of the original EU-15 group.

2. LITERATURE REVIEW

FDI plays an essential role in the host country's firm innovation performance, as foreign firms give local firms a chance to innovate via spillover and demonstration effect. Further, innovation is regarded as a powerful stimulator that aids micro-level firms to flourish and achieve success (Abbas, Bresciani, et al., 2025). The affiliation of multinational organizations significantly expands a firm's capability to innovate by aiding firms in overcoming impediments such as limitations of resources, funds, technology, and market information. Due to the availability of resources, organizations receiving FDI are more likely to appeal to and retain better-skilled and qualified employees through better compensation and reward packages than usual firms. Consequently, better financial conditions lead to organizational innovation.

FDI is considered an inexpensive technology transfer, particularly for developing nations, as they have limited funds and resources to acquire the latest technology (Zhou et al., 2023). As foreign firms enter the host country, local firms can learn new technologies via demonstration effect and try to hire workers of foreign firms to adopt these technologies. Furthermore, foreign entry into the host country leads to increased competition in the domestic market. The local firms either try to innovate or hire skilled labor to remain in the market. The demonstration effect occurs when local firms directly contact MNCs. Moreover, when local firms have limited knowledge about the cost and benefits of producing new products, they will try to imitate the technologies of MNCs (Wang et al., 2022).

Al-Kwifi et al. (2020) stated that MNCs' foreign subsidiaries increase competition in the domestic economy, and, in response, local firms stimulate their resources to compete with their rivals. This competitive pressure forces local firms to adopt new technologies and production techniques to retain their market identity (Abbas, 2025). Knowledge transfer is also a type of spillover through which domestic firms attain better organizational performance (Abbas, Dabic, et al., 2025; Fan et al., 2023) and innovation from FDI. Inward FDI can develop opportunities for local organizations to upgrade their technologies via learning (Ferreira et al., 2024). Networking is another type of spillover that is also important for the innovation performance of local firms (Zhao et al., 2022). Through networking (local and national), local firms can enhance their research and development levels and innovate. Moreover, firms within foreign linkages have more innovations than those with local associations. Local and foreign firms also collaborate through joint venture programs to achieve parallel goals. Hence, foreign-invested firms investing and operating in other industries lead to inter-industry spillover. These kinds of spillover may affect supplier-customer linkages, leading to increased innovation performance (Xiao et al., 2022).

The entry of foreign firms sparks competition in the host country's market, and these competitive effects provide incentives to local firms to use their existing resources more efficiently or to invest in R&D to innovate (Khan et al., 2022). There is a probability that competitive effects are not positive if domestic firms experience considerable loss because of ineffective technology. Generally, there are four productivity channels, namely labor mobility, demonstration effect, competition effect, and market access spillover, which primarily affect a country's innovation performance (Jiakui et al., 2023). Moreover, FDI's demonstration effect is imperative in overall organizational productivity (Mohebi & Komijani, 2018), especially in the quality of products/services and organizational framework. Proponents of knowledge transfer believe that foreign investment plays a key role in the diffusion of innovation activities in host firms. Firms with a higher innovation capacity improve their chances to access funds externally by utilizing professional networking (Kumari et al., 2022).

2.1. Relationship Between FDI and Innovation

FDI inflow into the host country enhances innovative activities via two channels: firstly, the transfer of accumulated knowledge through the transfer of technology or employees' mobility; secondly, after FDI, firms have more funds to spend on R&D; thus leading to enhanced innovation (Nyeadi & Adjasi, 2020). FDI (inward and outward) positively affects the creative competencies of firms. Zhang et al. (2022) researched South Asian countries from 2000 to 2011 and concluded that R&D is crucial in determining innovation. They also observed that FDI positively impacts the innovation activities of firms. Still, its intensity depends on

absorptive capacity and resources, aiding the firm's technological innovation. Loukil (2016) said that FDI channelizes modern technology from technologically advanced nations to developing ones; however, a corresponding asset is necessary for effectiveness.

While examining the relationship between FDI and firms' competition in developed countries, Murthy et al. (2017) stated that inward FDI leads to increased competition in the domestic market, decreasing the domestic firm's profitability. In reply, firms must produce more efficient and improved products that maintain their market position (Xie et al., 2022). The result varies from industry to industry, and it depends upon the ability and competency of domestic firms to respond to these foreign challenges (Pan et al., 2022). When foreign firms invest in host countries, local firms try to imitate their technologies. The spillover effect from these MNCs depends upon the complexity of their products and how well competitors can understand them. Therefore, when products are sold and manufactured by horizontal FDI, they are easy to imitate because of production and sale in the same country.

On the other hand, if the goods associated with vertical FDI are labor-intensive and require less technology, they may be more susceptible to imitation. Although numerous scholars have examined the relationship between foreign direct investment (FDI) and innovation from different perspectives, it remains uncertain whether FDI enhances the innovative performance of manufacturing firms in host nations. To do so, the following hypothesis is put forth:

H_1*: Direct investment from foreign countries has been shown to significantly and positively affect the innovativeness of host-country enterprises.*

2.2. High Technology Exports and Innovation.

Following the path-dependent character of internationalization, the learning view of the global operation of multinational firms has emerged. It demonstrates that the process is not instantaneous and that businesses continually learn from market experience, influencing future export decisions. Many companies export their products to adjacent markets as a first step toward globalization. After gaining more knowledge and experience, these firms become the persistent exporter of goods that enhance innovation (Nyeadi & Adjasi, 2020). Zaman *et al.* (2019) studied the relationship between international competition and domestic industry high-technology export. They said that it positively affects the innovative activities in the host countries because high-tech products require more sophisticated methods and techniques. Marjit and Ray (2017) stated that with advanced technology and exports, the performance of firms is boosted. Moreover, the

intensity of competition also rises with the existence of advanced technology, which ultimately leads to higher productivity growth.

Ekananda and Parlinggoman (2017) studied the role of FDI in high and non-high-tech exports covering 50 countries over two decades. They suggested that high-technology export organizations covering high-tech-intensive exports and non-high-tech export countries possess substantial productivity and innovation relative to local industries. Trlaković, Despotović, and Ristić (2018) investigated the relationship between technology-intensive exports and Western Balkan countries' productivity (WBC). The results state that the manufacturing sector possesses a significant effect on increasing productivity and suggest that to develop, more nations should invest in high technology-intensive industries to abstain from massive dependence on imports. Mohebi and Komijani (2018) analyzed the relationship between FDI and innovation in the US, China, and Japan. They found that foreign competition due to the entry of foreign firms increases the innovative capability of host country firms. Further, their results depict that both FDI positively and significantly affect product and process innovation. However, the relationship between high-tech exports and innovation is rarely reported in comprehensive manners. Particularly in the context of EU and CEEC regions. For this reason, following hypothesis is proposed;

H_2: *There is a positive correlation between high-tech exports and domestic innovation efforts.*

2.3. Research and development and innovation

Nyeadi and Adjasi (2020) conducted a study examining how foreign direct investment (FDI) impacted indigenous firms' innovation and absorptive capacity. They argue that knowledge production with well-equipped human capital, such as scientists, engineers, researchers, and R&D spending, is where domestic innovation capability begins. They dug deeper into the idea that a country's innovation potential is strongly linked to its expenditure on research and development at home.

According to Zaman *et al.* (2019), foreign firms tend to innovate with a higher propensity and higher ratios of R&D compared to domestic firms in Turkey. He compared three types of R&D activities at national and foreign establishments. His findings highlighted the significant role of R&D in the growing activities of the Turkish manufacturing sector. In the presence of foreign firms in-country, domestic firms prioritize strengthening their creative capability to survive and compete with their foreign counterparts, and domestic firms focus on their R&D activities to construct and improve their innovation capability (Cunningham et al., 2016). Moreover, few studies have found that FDI and R&D activities can strengthen the host country's propensity to become more creative because they stimulate the R&D activities of host firms (Maradana et al., 2017). Since this phenomenon is rarely

studied from the EU and CEES regions' perspective, the following hypothesis is proposed:

H3: *Research and development activities are positively associated with innovation activities in host countries*

2.4. Human capital and innovation

In the context of economics, human capital refers to the sum of an individual's education and work-related experience. Knowledge, skills, and talents are all components of an individual's competence, allowing them to carry out a given activity (Habib, Abbas and Noman, 2019). When workers invest in themselves by expanding their knowledge and skill sets, they boost their human capital, paving the way for the commercialization of technological progress and economic expansion in the long run. According to Azam's (2019) study of human capital's impact on economic growth in the so-called "Commonwealth Independent States." The benefactor country needs highly skilled people to generate complex negotiations due to the likely increase in costs associated with technology transfer brought on by robust intellectual property protections, which boosts producer bargaining power in the marketplace.

Mohebi and Komijani (2018) argued that foreign firms force incumbent firms to make themselves more efficient and productive by investing in human or physical capital or paying more attention to increase their productivity. Foreign companies train their employees in their operational sites, and this labor becomes available for the domestic economy; this is another source of domestic economy improvement from foreign firms. Labor mobility from foreign to local firms can provide a bridge to catch up with technological gaps because these employees transfer their knowledge from MNCs to local firms.

Nyeadi and Adjasi (2020) argued that selecting skilled labor and firms is significant and essential for innovation performance. They found that multinational enterprises positively affect the incumbent firms' performance because the entry of foreign firms increases the productivity and innovation performance of local firms via the demonstration effect. Felin and Hesterly (2007) stated that the center of knowledge lies at an individual level. Still, we all accentuate the firm level as these technological innovations predominantly contribute to the firm level rather than individually. That's how organizations can benefit from human capital as a resource to spur innovation. Considering the pivotal role of intellectual in the economic growth, this research claims that human capital plays a critical role in the innovation level of the host country in EU and CEES. Thus, the following hypothesis is proposed:

H4: *Human capital is a significant positive predictor of the innovation level of the host country*

2.5. FDI-based knowledge spillovers and innovation

Some knowledge spillovers from foreign firms to local firms through multiple channels, demonstration effect, and labor turnover. When an MNC establishes its subsidiary in another country, the likelihood of knowledge spillover increases through labor mobility from foreign firms to local firms. Chen et al. (2023) argue that geographical frontiers may be necessary for knowledge spillovers and information flows from one firm to another. As distance increases, the cost of transferring knowledge will also rise. Geographical proximity is also essential for knowledge spillovers. According to Jaffe et al. (2020), a firm's R&D activities can benefit its neighboring firm via spillovers, which have a noticeable impact on other firms.

Spatial proximity is essential for technological and knowledge spillover. It means that if a firm's neighbor produces more patents from R&D activities, it will also positively impact the other firms' performance from spillovers. Fosfuri et al. (2021) examined the relationship between FDI and patent registration from US multinationals to Japan and suggested a positive association. They analyzed a model focusing on spillovers generated by foreign firms in host countries. After training their local workers, they indicated that MNCs use superior technologies in their foreign subsidiaries. Technological spillovers from FDI firms arise when local firms hire these trained workers.

A knowledge spillover from FDI occurs when foreign firms invest in host countries, and these firms have better technological and organizational skills than local firms. Görg and Greenaway (2024) found that the acquisition of foreign technology from FDI can lead to an increase in human capital acquisition. Multinational firms demand skilled labor to continue their production processes. They invest in training programs for their workers in the host country, and it's tough for them to hide their technologies. The mobility of labor and technical expertise from these multinational firms to domestic firms can generate productivity and knowledge spillover. Thus, this research claims the following hypothesis;

H_5: *FDI-generated knowledge spillover among firms has a significant positive impact on the innovation performance of firms in the host country*

2.6. Institutions and innovation

Economies institutions encourage new business ventures through financing and protection and encourage innovation by reducing the barriers to new business development . Market stabilization institutions benefit different industries, such as finance, telecommunication, and transport. These institutions lower the macroeconomic volatility, corruption, and financial crisis. Further, it encourages capital investment and R&D activities (Chen & Funke, 2011). Political risk and governmental enforcement of law impact FDI flow from both the host country and firm perspective (Nyeadi & Adjasi, 2020).

Political stability and institutional quality also play a vital role in attracting foreign firms and investors. Busse and Hefeker (2017) explored different aspects of governmental law enforcement and political stability that impact the flow of foreign firms. Foreign direct investment (FDI) attraction was significantly affected by contract enforcement, government stability, and the absence of internal strife. Other related research provides evidence of the sovereign risk while attracting the FDI, offering governmental policymakers insights into formulating policies to combat that risk. The research by Chen and Funke (2021) suggested that foreign firms are more sensitive to institutional uncertainty risk while making investments. However, different researchers suggested that governmental incentive packages are the better option to attract more FDI flows.

It is well known that innovation is an essential determinant of economic performance. The structure of institutions in an economy influences it. The institutional structure affects the external and internal factors of a firm's innovation activities in an economy. For example, good regulatory quality and less economic corruption foster R&D activities. However, countries with poorer institutional quality and a higher level of corruption distract local firms from engaging in innovative activities. This study claims that high regulatory quality and well-functioning institutions favor the R&D activities that nurture creative activities. Thus, the following hypothesis is proposed;

H_6: *Regulation's quality and control of corruption positively impact domestic firms' innovation performance.*

3. DATA AND METHODOLOGY

3.1. Data

3.1.1. Data sources

This study investigates the impact of technology transfer and FDI on firms' innovation performance using panel data from 15 EU countries and 11 CEEC

countries from 2011 to 2022. The data used in this study are taken from different secondary sources like the World Development Indicator, World Governance Indicators (*WDI*, 2023), UNCTAD, and OECD statistics. Further, Regulatory Quality (RQ) data is taken from WGI. Similarly, FDI inflow (Percentage of GDP) variable data is taken from UNCTAD (see Table 1 for a detailed list of variables, their sources, and expected impact on innovation). The number of patent applications is the dependent variable in the analysis and is taken from OECD statistics. The authors also analyzed the effect of manufacturing industry FDI in these countries to assess the spillover effect of manufacturing sector FDI on innovation performance in CEEC and EU-15 countries. Data on GDP, per capita GDP, research in R&D, expenditures in R&D, GDP growth, and high technology exports are taken from WDI. Similarly, patent application and FDI data are taken from OECD statistics. FDI manufacturing industry inflow data is taken from OECD stats. The authors took the lag and logarithm of all variables. Taking the lag of FDI and other variables was to address the endogeneity problem.

3.1.2. Data and variables

Following Calderón-Martínez and García-Quevedo's (2013) study, the authors used patent application to measure innovation, i.e., dependent variable. Patent applications are defined as the number of patents for which the local firms seek protection in the respective countries, and it is a proxy of innovation and R&D output. It is calculated by new patents that are registered at EPO. These patents were registered against new technologies in nanotechnologies, Information and Communications Technology (ICT), and health sciences. Human capital is calculated by following Whalley and Zhao's (2013) criteria, which state that human capital is positively associated with innovation. The regulatory quality is incorporated by following Barasa et al. (2017) studies, which is the proxy for governance quality at the country level.

FDI is another independent variable (percentage of GDP). Many studies explain that FDI flows strengthen the host country's propensity to innovate by stimulating firm activities that foster innovation. The authors took this variable's lag since the previous year's FDI will generate a patent after some time. GDP per capita is another variable that shows a country's demand and overall economic performance. R&D expenditure is included following Cheung and Lin (2004) as the measure of input of R&D activities, which are spent to increase the knowledge base for creative work.

Table 1 *Variables, expected relationship, and their sources*

Variable name	Proxy	Source	Expected sign
R&D expenditure	R&D input	WDI	Positive
High-tech exports	R&D intensive products	WDI	Positive
Human Capital	Availability of Human capital	Penn World table	Positive
GDP per capita	Market demand	WDI	Positive
FDI inflow	Foreign investment	OECD	Positive
Regulatory Quality	Rules and regulations of a country	WGI	Positive
Control of corruption	Government control over corruption	WGI	Positive

*Authors proposition

Table 2 *Descriptive statistics*

Variable name	Observations	Mean	Std. Dev.	Min	Max
$lnPatent$	442	5.48395	2.388099	-0.4054	10.1072
$lnFDI$	436	3.53374	0.785464	.08942	5.77514
$lnRQ$	428	0.08726	0.515613	-3.9007	0.73075
$lnCControl$	421	-0.0203	0.870586	-2.6593	1.0438
$lnGDPgrowth$	421	1.06034	0.934357	-4.5905	2.50416
$lnRnDexp$	419	0.19789	0.620321	-1.0115	1.41828
$lnHightexp$	436	22.1288	2.0369	7.4952	25.9348
$lnGDPpc$	442	9.74134	0.927676	6.96892	11.6265

*Authors calculations based on data obtained from WDI, WGI, UNCTAD, and OECD statistics.

4. EMPIRICAL ESTIMATION AND METHODOLOGY

Cheung and Lin (2004) inspired the methodology used in this study to estimate the effect of FDI on innovation in the CEEC region. The authors used panel data that provided more information and efficiency by combining cross-sectional and time-series data. Moreover, panel data is more consistent because it efficiently measures and detects outcomes compared to time series and cross-section data. The primary concern in analyzing the panel data is to choose the right and valid model. While analyzing the panel data, the ordinary least square method gives biased results or estimates because the unobserved error term correlated with the error term.

There are multiple measures for panel data analysis, such as the fixed effect model (FEM) and the random effect model (REM). In FEM, the intercept of the regression can differ across the individual. To decide whether the fixed effect model (FEM) or the Random effect model (REM) be used, the Hausman test was performed. The null hypothesis H_0: $E\ (\varepsilon i\ |Xit) = 0$ of Hausman test implies that REM yields efficient and consistent estimates if H_0 is true. However, under the alternative hypothesis H_A: $E\ (\varepsilon i\ |Xit) \neq 0$, the FEM model yields efficient and consistent estimates. In other words, H_0 of the Hausman test suggests that the coefficient difference is not systematic, while H_A indicates that the difference in coefficients is systematic. In the current study, the Hausman test suggests that the difference in coefficient is systematic, so we followed FEM (See table 3). The dependent variable is $lnPatent_{it}$ in the equation 1 and 2, which is the new patent citation in the respective country that indicates the innovation. Further, on the right side of the equation, we have used six independent variables: FDI, regulatory quality, human capital, R&D expenditure, and GDP per capita. In equations (1) & (2), respectively, the script "*i*" denotes the country, and "*t*" denotes the period that is the year.

Table 3 *Hausman specification test*

	(b) RE	(B) FE	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
$lnFDI$	0.154806	0.225782	-0.087976	0.0196906
$lnRQ$	-0.09843	-0.09568	0.0342511	0.0269051
$lnHC$	0.010941	0.018015	-0.0070739	0.0097868
$lnRnDexp$	0.638792	0.495779	0.1430133	0.0339111
$lnHightexppm$	0.38997	0.356171	0.043799	0.0253327
$lnGDPpc$	0.591405	0.541546	0.0498589	0.0268078

Notes: b = consistent under Ho and Ha; obtained from xtreg B = inconsistent under Ha, efficient under Ho; obtained from xtreg χ^2 (6) = (b-B)'[(V_b-V_B)^(-1)](b-B)=45217.43Prob>χ^2 = 0.0000

*Authors calculations based on data obtained from WDI, WGI, UNCTAD, and OECD statistics.

(Equation 1)

$$lnPatent_{it} = \beta_0 + \beta_1 lnFDI_{it-1} + \beta_2 lnRQ_{it-1} + \beta_3 lnHC_{it-1} + \beta_4 lnRnDexp_{it-1} + \beta_5 lnHightexp_{it-1} + \beta_6 lnGDPpc_{it-1} + \in_{it}$$

(Equation 2)

$$lnPatent_{it} = \beta_0 + \beta_1 lnFDI_{it-1} + \beta_2 lnRQ_{it-1} + \beta_3 lnHC_{it-1} + \beta_4 lnR\&D\ Exp_{it-1} + \beta_5 lnHightexp_{it-1} + \beta_6 lnGDPpc_{it-1} + \beta_7 lnFDI_{it-1} \times lnRnDexp_{it-1} \in_{it}$$

Where $lnFDI$ denotes FDI inflow (percentage of GDP) in country *i* at time *t*, similarly $lnRQ$ is a regularity quality that measures the implementation of rules and regulations of a country by the government. $lnR\&D\ Exp$ are expenditures in R&D that measure the intensity of expenditures in research and development. Similarly, per capita GDP is denoted by $lnGDPpc$ those measures the market's demand. The variable $lnHC$ denotes Human capital, which plays a positive role in innovation because the countries that have a high level of human capital can generate more patents. The authors incorporated another independent variable, i.e., high technology exports $lnHightexp$; with the logic, if a country is exporting more technology-intensive products, it will generate more innovation in the form of new patents.

5. RESULTS AND DISCUSSION

The researchers ran a correlation test to make sure there wasn't any connection between the factors mentioned above. Table 4 of the correlation matrix demonstrates that the level of the correlation coefficient is under 0.5, meeting the threshold set by Abdullah (2006) of being under 0.85. Researchers consider the results without making any mistakes or adjustments by using the numbers in the correlation findings in Table 6 in the appendix.

Table 4 *Correlation table*

	$lnFDI$	$lnRQ$	$lnHC$	$lnRnDexp$	$lnHightex$	$lnGDPpc$	$lnFDI$
$lnFDI$	1						
$lnRQ$	0.2117	1					
$lnHC$	0.2381	0.027	1				
$lnRnDexp$	0.2971	0.057	0.1321	1			
$lnHightec$	-0.017	0.041	0.3495	0.1882	1		
$lnGDPpc$	0.1224	0.054	0.4077	0.3721	0.2878	1	
$lnFDI$	0.25	0.399	0.2145	0.2412	-0.241	0.1511	1

*Authors calculations based on data obtained from WDI, WGI, UNCTAD, and OECD statistics.

Aggregate level analysis in Table 5 shows both regions of EU-15 Countries and CEE countries, and these results provide the FE model for 15 EU countries and 10 CEE countries, respectively. The empirical results in Table 6 show the significant and positive impact of FDI on innovation in both regions, i.e., CEEC and EU-15

countries. As per the aggregate analysis in Table 5, it can be seen that the impact of FDI on innovation is greater as compared to the CEEC region because of the larger coefficient (***EU-15*** β=0.421, p< 0.01; for ***CEEC*** β= 0.195, p< 0.01). It is seen that a 1% increase in FDI (percentage of GDP) is associated with a 0.421% increase in the likelihood of innovation, as a patent application is a proxy variable for innovation, and FDI brings new technology from foreign countries. Therefore, the first hypothesis (H1) is accepted, i.e., FDI has a significant and positive impact on the probability of innovation. This finding aligns with Menghinello et al. (2021), who found that FDI brings advanced technology to the host countries, enhancing competition and worker mobility and positively influencing innovation. Further academic debate on firm innovation has mainly considered the FDI and spatial clustering as a driver of innovation and economic growth (Habib et al., 2019)

Table 5 *CEEC and EU 15 countries Aggregate level analysis*

	EU 15 countries		**CEEC Countries**		**EU 15+ CEEC**	
	Equation 1	*Equation 2*	*Equation 1*	*Equation 2*	*Equation 1*	*Equation 2*
$lnFDI_{t-1}$	0.421***	0.476**	0.195***	0.155**	0.226***	0.253**
	(0.0603)	(0.105)	(0.165)	(0.173)	(0.103)	(0.112)
$lnRQ$	0.335***	0.260**	0.151*	0.163**	0.1957*	0.13
	(0.0859)	(0.0854)	(0.193)	(0.169)	(0.0811)	(0.0872)
$lnHC$	0.0220**	0.0170*	-0.109	-0.111	0.018*	0.0201*
	(0.0147)	(0.0138)	(0.062)	(0.063)	(0.0269)	(0.0254)
$lnR\&Dexp$	0.458***	0.423***	0.237**	0.193**	0.296**	0.600**
	(0.142)	(0.524)	(0.246)	(1.988)	(0.191)	(0.725)
$lnHightexp$	0.444**	0.369**	0.0782	0.0944	0.346***	0.245**
	(0.194)	(0.146)	(0.151)	(0.160)	(0.11)	(0.105)
$lnGDPpc$	0.412***	0.400**	0.353***	0.334***	0.442***	0.460***
	(0.147)	(0.144)	(0.176)	(0.179)	(0.118)	(0.105)
$lnFDI \times lnR\&Dexp$		0.449**		0.316**		0.207*
		(0.209)		(0.309)		(0.192)
_cons	0.999	0.747	3.197**	3.454**	-1.372	-0.597
	(1.904)	(1.695)	(1.622)	(1.471)	(1.225)	(1.066)
N	221	221	142	142	363	363
R-sq	0.601	0.622	0.625	0.616	0.615	0.623
adj. R-sq	0.619	0.686	0.648	0.646	0.606	0.624

*Note: Standard error in parentheses: *p<10, **p<0.05, ***p<0.01*

*Authors calculations based on data obtained from WDI, WGI, UNCTAD, and OECD statistics.

The analysis of H2, i.e., high technology exports are positively associated with innovation activities in the host country, also displays a significant and positive impact on innovation in EU-15 countries. In contrast, it does not affect innovation in the CEEC region (***EU-15*** β=0.444, $p< 0.01$; for ***CEEC*** β=0.0782, $p< 0.05$). In the initial stage of internationalization, many firms export goods to nearby markets; after gaining more knowledge and experience, these firms become persistent exporters of goods that enhance innovation in host countries (Andersson & Lööf, 2009). Exporting to other countries encourages firms to remain more competitive, pushing them to innovate. Secondly, international exposure provides an opportunity to access new knowledge and information, which can directly affect innovation through exporting partners. Several studies have found that international competition between the high-tech industry and their exports forces local firms to innovate in this competitive environment. In this regard, our results are in line with past studies. However, the magnitude of high-tech exports on innovation in the CEEC region is weak because these countries do not produce high-tech products as the EU-15 region, and we see the coefficients in Table 6.

Further, we examined the impact of R&D on innovation. We found a positive association between them for both regions, leading to the acceptance of H3, i.e., R&D activities are positively associated with the innovation activities in the host country. The R&D expenditures coefficients have a higher impact on innovation in EU-15 countries and a lesser impact in the CEEC region in equation 1 (***EU-15*** β=0.458, $p< 0.01$; for ***CEEC*** β= 0.237, $p< 0.01$). R&D expenditures play a significant role in the innovation process, as proposed by Habib et al. (2019). In the presence of foreign firms in countries, domestic firms prioritize improving innovation capability to survive and compete with their foreign counterparts, and domestic firms focus on their R&D activities to construct and improve their innovative products and services (Cunningham et al., 2016). This finding also relates to the study of Kayalvizhi and Thenmozhi (2018), who examined the relationship between FDI and R&D activities and said that such a relation strengthens the host country's propensity to innovate because it stimulates firms' activities, fostering overall innovation. The present research findings postulate that the countries that invest more in R&D files for more patent generations influence overall innovation activities.

In our findings, human capital significantly positively impacts innovation in EU-15 countries; however, its impact in the CEEC region is insignificant. Therefore, H4, which states that human capital is positively associated with innovation, is accepted for the EU-15 region and rejected for the CEEC region. These findings comply with Felin and Hesterly's (2007) results, which state that human capital significantly increases innovation. Still, these findings contradict the study above if we incorporate the CEEC region. Further, several researchers argued that human capital

is a vital component that drives technological progress and innovation (Acemoglu et al., 2009). The report by WIPO (2015) pointed out human capital as an innovation process factor or human factor that leads to spur innovation.

In equations 1 and 2, regulatory quality has a significant and positive impact on innovation in both regions, and these have a more significant and positive impact on EU-15 countries and a lesser impact on CEE countries. Therefore, H6, which explains the relationship between regulation quality and innovation, is also accepted (see table 6 ***EU-15*** β=0.335, p< 0.05; for ***CEEC*** β= 0.151, p< 0.10). These findings align with Barasa et al.'s (2017) and Fuentelsaz et al.'s (2018) studies, which explain that regulatory quality and low corruption positively impact firms' innovativeness. Regulations are considered crucial determinants of the economic system's industrial activities that foster innovation in the economies (Christenson & Raynor, 2013). However, countries with weaker institutional and regulatory quality distract local firms from engaging in innovative activities. Therefore, high regulatory quality and well-functioning institutions favor R&D activities, which are innovative activities' nurturing factors (Elert et al., 2017).

Our results are consistent with the study of Barasa *et al.* (2017), which states that FDI has a positive and significant effect on stimulating technological innovations. It shows that a rapid increase in the FDI inflows in the economies leads to enhanced innovation, thus positively affecting economic growth. This study highlights the importance of regulations as this determinant enhances innovation level in European countries because better regulatory quality in the region enhances the confidence of foreign and local firms, and previous studies, such as Maicas and Montero (2018) and Fuentelsaz et al., (2018) also confirm these findings. However, weak institutional enforcement and regulations impede innovation because competitors and peers try to imitate the products the industry incumbents offer.

Table 6 *CEEC plus EU-15 Manufacturing industry*

	EU 15 countries		**CEEC Countries**		**EU 15+ CEEC**	
	Equation 1	*Equation 2*	*Equation 1*	*Equation 2*	*Equation 1*	*Equation 2*
$lnFDIManufactuing_{t-1}$	0.221***	0.276**	0.114**	0.146*	0.0719*	0.0277
	(0.0603)	(0.105)	(0.0810)	(0.557)	(0.0284)	(0.0399)
$lnRQ$	0.0235***	0.0260**	-0.290	-0.287	0.0732*	0.0763**
	(0.0859)	(0.0854)	(0.432)	(0.435)	(0.146)*	(0.145)
$lnHC$	0.0120***	0.0170**	0.091	0.095	-0.0193	0.0186*
	(0.0147)	(0.0138)	(5.278)	(5.626)	(0.0245)	(0.0237)
$lnRnDexp$	0.464**	0.444**	0.363	0.361	0.509*	0.698
	(0.162)	(0.169)	(0.192)	(0.183)	(0.211)	(0.378)
$lnHightexp$	2.662***	2.737***	0.292	0.2244	0.496***	0.499***

	(0.744)	(0.743)	(0.151)	(0.160)	(0.169)	(0.168)
$lnGDPpc$	0.477**	0.479**	0.353***	0.334***	0.802***	0.798***
	(0.176)	(0.176)	(0.176)	(0.179)	(0.197)	(0.195)
$lnFDI \times lnRnDexp$		0.149*		0.419**		0.449*
		(0.319)		(0.309)		(0.309)
_cons	0.899	0.647	2.197**	2.454**	1.372	0.577
	(1.604)	(1.595)	(1.622)	(1.471)	(1.125)	(1.056)
N	187	187	131	131	318	318
R-sq	0.601	0.622	0.577	0.557	0.615	0.623
adj. R-sq	0.619	0.686	0.591	0.585	0.606	0.624

*Note: Standard error in parentheses: *p<10, **p<0.05 , ***p<0.01*

*Authors calculations based on data obtained from WDI, WGI, UNCTAD, and OECD statistics.

6. CONCLUSION, IMPLICATIONS, AND LIMITATIONS

This study utilizes a framework to assess the effect of overall FDI from the manufacturing sector, R&D spending, human capital, high-tech exports, and regulations on innovation in the CEE countries, comparing them with the EU-15 nations. Our findings suggest that FDI likely fosters innovation in both the CEEC and EU-15 regions. The econometric analysis also reveals the influence of other factors, such as regulatory quality, R&D spending, high-tech exports, and human capital, on innovation in both regions. A second econometric analysis at the manufacturing level indicates that FDI in the EU-15 region has a more significant impact on innovation compared to the CEEC region. This difference may be attributed to weaker institutions, limited government control, and a lower focus on attracting more FDI in the CEEC. The results further show that the quality of government enforcement of regulations encourages domestic firms to innovate, while stronger regulatory quality attracts more FDI, providing host countries with better access to new technologies from abroad.

In the EU-15 regions, R&D expenditures are the most crucial factor driving innovation activities. However, at the manufacturing level of FDI analysis, R&D spending has little impact on innovation in the CEEC region. High-tech exports significantly influence patent applications, as countries or regions exporting high-tech products are more likely to innovate, given that the high-tech sector is more R&D-intensive than others. Similarly, economic development, as measured by per capita GDP, positively impacts innovation activities, indicating that a high-quality market increases the likelihood of innovation.

Based on our results and empirical findings, this study has several important policy implications that FDI-related policies should be promoted and more FDI projects are facilitated. This attempt will lubricate the interaction process between domestic firms and foreign MNCs and, as a result, generate more inter-industry spillovers that ultimately impact domestic innovation capability. Considering the results of this research, it is recommended that governments of CEEC and EU 15 countries try to attract more FDI via lenient and effective policies to stimulate domestic innovation capability. Results suggest that R&D expenditures and researchers in R&D are important drivers of innovative activities; governments of these economies should invest more in R&D by allocating more resources to foster local innovation activities. Similarly, adequate rules and regulations (institutional framework) of host countries are also an important factor that encourages innovative activities. Therefore, promoting regulatory quality may increase the likelihood of innovation in host countries. Similarly, it was found that the manufacturing sector FDI plays an important role in innovation activities in the EU 15 region because it is more R&D intensive. Therefore, policymakers of these economies should design policies that favor intensive technological FDI that introduce more innovations.

This study has several limitations. One key limitation is that the authors did not empirically assess the impact of FDI on labor mobility, imitation, and the demonstration effect due to a lack of available data in the CEEC and EU-15 regions. Another limitation is that the number of new products and processes introduced is a more accurate measure of innovation performance, which could be used in future studies. The effect of FDI differs across industries and firms, so future research could expand the analysis to various sectors, such as the services industry. Additionally, future research could include firm-level analysis in both the CEEC and EU-15 regions. Researchers could also examine the demonstration effect using utility model patents and explore the crowding-out effect on invention patents. Lastly, the impact of external design patents in an economy could be analyzed to understand the spillover effect of FDI on minor innovations.

REFERENCES

Abbas, J. (2025). From corporate social responsibility to human social responsibility: A pathway for a sustainable society. *Journal of Cleaner Production*, *494*, 144979. https://doi.org/10.1016/j.jclepro.2025.144979

Abbas, J., Bresciani, S., Subhani, G., & De Bernardi, P. (2025). Nexus of ambidexterity and frugal innovation for enhanced ESG performance of entrepreneurial firms. The role of organizational capabilities. *International Entrepreneurship and Management Journal*, *21*(1), 47. https://doi.org/10.1007/s11365-024-01062-5

Abbas, J., Dabic, M., & Halaszovich, T. (2025). From distractions to detox: Analyzing how recovery experiences mediate the relationship between social cyberloafing and social sustainability. *International Journal of Entrepreneurial Behavior & Research*, *31*(11), 214–234. https://doi.org/10.1108/IJEBR-07-2024-0772

Abbas, J., & Khan, S. M. (2022). Green knowledge management and organizational green culture: An interaction for organizational green innovation and green performance. *Journal of Knowledge Management*. https://doi.org/10.1108/JKM-03-2022-0156

Acemoglu, D., Aghion, P., & Zilibotti, F. (2009). Distance to frontier, selection, and economic growth. *Journal of the European Economic Association*, *4*(1), 37–74.

Ahmad, A. (2020). Ethnic discrimination against second-generation immigrants in hiring: Empirical evidence from a correspondence test. *European Societies*, *22*(5), Article 5.

Al-Kwifi, O. S., Farha, A. K. A., & Zaraket, W. S. (2020). Competitive Dynamics Between Multinational Companies and Local Rivals in Emerging Markets. *FIIB Business Review*, *9*(3), 189–204.

Andersson, M., & Lööf, H. (2009). Learning-by-exporting revisited: The role of intensity and persistence. *Scandinavian Journal of Economics*, *111*(4), 893–916.

Awan, U. (2020). Enhancing green product and process innovation: Towards an integrative framework of knowledge acquisition and environmental investment. *Business Strategy and Environment*, 1–13. https://doi.org/10.1002/bse.2684.

Barasa, L., Knoben, J., Vermeulen, P., Kimuyu, P., & Kinyanjui, B. (2017). Institutions, resources and innovation in East Africa: A firm level approach. *Research Policy*, *46*(1), 280–291.

Branstetter, L. (2006). Is foreign direct investment a channel of knowledge spillovers? Evidence from Japan's FDI in the United States. *Journal of International Economics*, *68*(2), 325–344.

Busse, M., & Hefeker, C. (2007). Political risk, institutions and foreign direct investment. *European Journal of Political Economy*, *23*(2), 397–415.

Calderón-Martínez, M. G., & García-Quevedo, J. (2013). Knowledge transfer and university patents in Mexico. *Academia Revista Latinoamericana de Administración*.

Chen, H., Yi, J., Chen, A., Peng, D., & Yang, J. (2023). Green technology innovation and CO2 emission in China: Evidence from a spatial-temporal analysis and a nonlinear spatial durbin model. *Energy Policy*, *172*, 113338. https://doi.org/10.1016/j.enpol.2022.113338

Chen, Y. F., & Funke, M. (2011). Institutional uncertainty, economic integration, and vertical foreign direct investment decisions. *Open Economies Review*, *22*(4), 593–612.

Christenson, C., & Raynor, M. (2013). *The innovator's solution: Creating and sustaining successful growth*. Harvard Business Review Press.

Cunningham, P., Gök, A., & Larédo, P. (2016). The impact of direct support to R & D and innovation in firms. In *Handbook of innovation policy impact*. Edward Elgar Publishing.

Ekananda, M., & Parlinggoman, D. J. (2017). The Role of High-Tech Exports and of Foreign Direct Investments (FDI) on Economic Growth. *European Research Studies*, *10*(4), 194–212.

Elert, N., Henrekson, M., & Stenkula, M. (2017). *Institutional reform for innovation and entrepreneurship: An agenda for Europe*. Springer International Publishing.

Erdilek, A. (2005). *R&D activities of foreign and national establishments in Turkish manufacturing. The Impact of Foreign Direct Investment on Development: New Measures, New Outcomes, New Policy Approaches*. Institute for International Economics.

Fan, Q., Abbas, J., Zhong, Y., Pawar, P. S., Adam, N. A., & Alarif, G. B. (2023). Role of organizational and environmental factors in firm green innovation and sustainable development: Moderating role of knowledge absorptive capacity. *Journal of Cleaner Production*, *411*, 137262. https://doi.org/10.1016/j.jclepro.2023.137262

Felin, T., & Hesterly, W. S. (2007). The knowledge-based view, nested heterogeneity, and new value creation: Philosophical considerations on the locus of knowledge. *Academy of Management Review*, *32*(1), 195–218.

Ferreira, J. J., Cruz, B., Veiga, P. M., & Ribeiro-Soriano, D. (2024). Knowledge strategies and digital technologies maturity: Effects on small business performance. *Entrepreneurship & Regional Development*, *36*(1–2), 36–54. https://doi.org/10.1080/08985626.2022.2159544

Fosfuri, A., Motta, M., & Rønde, T. (2001). Foreign direct investment and spillovers through workers' mobility. *Journal of International Economics*, *53(1)*, 205–222.

Fuentelsaz, L., Maicas, J. P., & Montero, J. (2018). Entrepreneurs and innovation: The contingent role of institutional factors. *International Small Business Journal*, *36*(6), 686–711.

Görg, H., & Greenaway, D. (2004). Much ado about nothing? Do domestic firms really benefit from foreign direct investment? *The World Bank Research Observer*, *19(2)*, 171–197.

Habib, M., Abbas, J., & Noman, R. (2019). Are human capital, intellectual property rights, and research and development expenditures really important for total factor productivity? An empirical analysis. *International Journal of Social Economics*, *46*(6), 756–774. https://doi.org/10.1108/IJSE-09-2018-0472

Jaffe, A., Trajtenberg, M., & Henderson, R. (2002). Geographic localization of knowledge spillovers as evidenced by patent citations. *Patents, Citations, and Innovations: A Window on the Knowledge Economy*, 155–178.

Jiakui, C., Abbas, J., Najam, H., Liu, J., & Abbas, J. (2023). Green technological innovation, green finance, and financial development and their role in green total factor productivity: Empirical insights from China. *Journal of Cleaner Production*, *382*(1), 135131. https://doi.org/10.1016/j.jclepro.2022.135131

Khadan, J. (2018). Estimating the Effects of Human Capital Constraints on Innovation in the Caribbean. *Economies*, *6*(2), 6–33. https://doi.org/10.3390/economies6020033

Khan, H., Abbas, J., Kumari, K., & Najam, H. (2022). Corporate level politics from managers and employees perspective and its impact on employees' job stress and job performance. *Journal of Economic and Administrative Sciences*. https://doi.org/10.1108/JEAS-12-2021-0246

Kim, H., Abbas, J., Haq, M. Z. U., Lee, J. H., & Hwang, J. (2023). Differences between robot servers and human servers in brand modernity, brand love,

and behavioral intentions in the restaurant industry. *Asia Pacific Journal of Marketing and Logistics*. https://doi.org/10.1108/APJML-03-2022-0214

Kumari, K., Abbas, J., Hwang, J., & Cioca, L. I. (2022). Does Servant Leadership Promote Emotional Intelligence and Organizational Citizenship Behavior among Employees? A Structural Analysis. *Sustainability*, *14*(9), 5231. https://doi.org/10.3390/su14095231

Loukil, K. (2016). Foreign direct investment and technological innovation in developing countries. *Oradea Journal of Business and Economics*, *1*(2), 31–40.

Maradana, R. P., Pradhan, R. P., Dash, S., Gaurav, K., Jayakumar, M., & Chatterjee, D. (2017). Does innovation promote economic growth? Evidence from European countries. *Journal of Innovation and Entrepreneurship*, *6*(1), 11–21.

Marjit, S., & Ray, M. (2022). Export profitability, competition and technology. *International Review of Economics & Finance*, *47*(1), 35–45.

Mohebi, M., & Komijani, A. (2018). NAIRU and productivity shocks: Evidence from three gigantic economies. *Applied Economics Letters*, *25*(12), 847–852.

Murthy, K. V., Bhanu, S., & Manoj, K. (2017). Inward Foreign Direct Investment and Economic Development of Developed Countries: Panel Regression Approach. *The IUP Journal of Applied Finance*, *22*(4), 55–75.

Najam, H., Abbas, J., Álvarez-Otero, S., Dogan, E., & Sial, M. S. (2022). Towards green recovery: Can banks achieve financial sustainability through income diversification in ASEAN countries? *Economic Analysis and Policy*, *76*, 522–533. https://doi.org/10.1016/j.eap.2022.09.004

Nyeadi, J. D., & Adjasi, C. (2020). Foreign direct investment and firm innovation in selected sub-Saharan African Countries. *Cogent Business & Management*, *7*(1), 1763650.

Pan, C., Abbas, J., Álvarez-Otero, S., Khan, H., & Cai, C. (2022). Interplay between corporate social responsibility and organizational green culture and their role in employees' responsible behavior towards the environment and society. *Journal of Cleaner Production*, *366*, 132878. https://doi.org/10.1016/j.jclepro.2022.132878

Tong, L., Chiappetta Jabbour, C. J., belgacem, S. ben, Najam, H., & Abbas, J. (2023). Role of environmental regulations, green finance, and investment in green technologies in green total factor productivity: Empirical evidence from Asian region. *Journal of Cleaner Production*, *380*, 134930. https://doi.org/10.1016/j.jclepro.2022.134930

Trlaković, J., Despotović, D., & Ristić, L. (2018). Impact of technology-intensive exports on GDP of Western Balkan Countries. *Journal of Policy Modeling*, *40*(5), 1038–1049.

Wang, S., Abbas, J., Sial, M. S., Álvarez-Otero, S., & Cioca, L.-I. (2022). Achieving Green Innovation and Sustainable Development Goals through Green Knowledge Management: Moderating Role of Organizational Green Culture. *Journal of Innovation & Knowledge*, *7*(4), 100272. https://doi.org/10.1016/j.jik.2022.100272

WDI. (2018). World Development Indicators. http://databank.worldbank.org/ddp/home.do

Whalley, J., & Zhao, X. (2013). The contribution of human capital to China's economic growth. *China Economic Policy Review*, *2*(1), 135–147.

Xiao, H., Khan, S. M., Huang, S., Abbas, J., Matei, M. C., & Badulescu, D. (2022). Employees' Green Enterprise Motivation and Green Creative Process Engagement and Their Impact on Green Creative Performance. *International Journal of Environmental Research and Public Health*, *19*(1), 1–13. https://doi.org/10.3390/ijerph2004010001

Xie, Z., Liu, X., Najam, H., Fu, Q., Abbas, J., Comite, U., Cismas, L. M., & Miculescu, A. (2022). Achieving Financial Sustainability through Revenue Diversification: A Green Pathway for Financial Institutions in Asia. *Sustainability*, *14*(6), Article 6.

Yu, S., Abbas, J., Álvarez-Otero, S., & Cherian, J. (2022). Green knowledge management: Scale development and validation. *Journal of Innovation & Knowledge*, *7*(4), 100244. https://doi.org/10.1016/j.jik.2022.100244

Zaman, M. R. S., Fan, H., Mohammued, E. A., Hossain, M. I., & Islam, M. A. (2019). Effects of export and technology on economic growth: Selected emerging Asian economies. *Economic Research-Ekonomska Istraživanja*, *32*(1), 2515–2531.

Zhang, J., Cherian, J., Sandhu, Y. A. B., Abbas, J., Cismas, L. M., Negrut, C. V., & Negrut, L. (2022). Presumption of green electronic appliances purchase intention: The mediating role of personal moral norms. *Sustainability*, *14*, 1–15.

Zhao, L., Gu, J., Abbas, J., Kirikkaleli, D., & Yue, X.-G. (2022). Does quality management system help organizations in achieving environmental innovation and sustainability goals? A structural analysis. *Economic Research-Ekonomska Istraživanja*, *0*(0), 1–24. https://doi.org/10.1080/1331677X.2022.2100436

Zhou, P., Abbas, J., Najam, H., & Alvarez-Otero, S. (2023). Nexus of renewable energy output, green technological innovation, and financial development for carbon neutrality of Asian emerging economies. *Sustainable Energy Technologies and Assessments*, *58*, 103371. https://doi.org/10.1016/j.seta.2023.103371