

ISSN 2384-9398

GeoProgress Journal

Volume 9, Issue 1, 2022



**GEOPROGRESS EDITIONS
NOVARA**



Geoprogess Association

at University of Eastern Piedmont
Via Perrone 18 – 28100 Novara, Italy

For the earth's ecosystem and human communities progress

Geoprogess is not-for-profit organisation founded in 2011 by professors from several Italian universities and scientific institutions with the aim at fostering knowledge, empowering humanity, and improving the quality of human resources, territories and the Earth's ecosystem. Among the activities Geoprogess is carrying out according to its mission, (www.geoprogess.eu), there is the publication of journals, at national and international level, and other kinds of writings, all of which are open access.

President: Francesco Adamo,

Board of Directors: Francesco Adamo, Vittorio Amato (Vice-Presidente), Eugenio M. Braja (Treasurer), Alessandro Capocchi, Maria Giuseppina Lucia.

Board of Auditors: Patrizia Riva (President), Paola Vola, Chiara Morelli.

Donations to Geoprogess for supporting its editorial and solidarity activities

Consistent with the association's aims, this and other online publications of Geoprogess are open access but they obviously have a cost. The same is true for initiatives concerning the protection of natural environments, landscape, cultural heritage, mainly for development cooperation programs in poor countries.

For these reasons, we urge readers to make a donation to the Association and possibly join and make a personal contribution.

*You can send your **donations** through: Bank transfer to Geoprogess
(Novara, via Perrone 18) at INTESA SAN PAOLO, Fil. 55000, Novara
(Italy) BIC: BCITITMM
Code Iban: **IT75R0306909606100000016996***

ISSN 2384-9398

Doi: <https://doi.org/10.20373/2384-9398/9.1.2022>

GeoProgress Journal

Volume 9, Issue 1, 2022



GEOPROGRESS EDITIONS

NOVARA

GeoProgress Journal (ISSN 2384-9398) is an open access e-journal submitted to a double-blind peer review (www.geoprogress-edition.eu). It is edited by Geoprogress (non-profit association) in line with its strategic objective to increase and disseminate knowledge in order to contribute to the progress of humanity (www.geoprogress.eu)

The ***GeoProgress Journal*** is published by Geoprogress with the collaboration of the Università del Piemonte Orientale



and it is part of the free access online publication community of the University of Eastern Piedmont (UPO). The readers may download articles totally or partially but the source must be cited.

Copyright © Geoprogress Onlus
Via Perrone 18 - 28100 Novara.
E-mail: info@geoprogress.eu

Editorial Staff of the GeoProgress Journal

Editor in chief: Francesco Adamo, Emeritus Professor, Università degli studi del Piemonte Orientale (Italy)

Associate Editor: Daniela La Foresta, Professor, Università degli Studi di Napoli "Federico II"

Scientific Advisory Board: Bjorn Asheim (Norway and Sweden), Huseyn Bagci (Turkey), Vincente Bielza de Ory (Spain), Vladimir Kolossov (Russia), Sergio Conti (Italy), Elena Dell'Agnesse (Italy), Labadi Fadwa (Palestine), Claudio Minca (Netherlands), Julian V. Minghi (USA), Maria Paradiso (Italy), Petros Petsimeris (France), Stephane Rosiere (France), Christian Vandermotten (Belgium), Peter Wiltshier (United Kingdom), Rawal Darshana (India)

Editorial Board: Vittorio Amato (Naples), Alessia Amighini (Novara), Margherita Azzari (Florence), Franco Farinelli (Bologna), Chiara Ferro (Naples), Marco Giardino (Turin), Giorgia Iovino (Naples), Luca Ruggiero (Catania), Piercarlo Rossi (Turin), Marcello Tadini (Novara), Angioletta Voghera (Turin)

Publishing Office: Stefania Albanese (Office Head), Davide Murmora (Webmaster), Edoardo Ardizzone (Web editor).
Francesco Scalera (Web editor)

Scientific Advisory Board for Special issues.

1) *Governance issues and rules, Political and Institutional Issues of Community Development, from local to global scale, International Co-operation:* Huseyn Bagci, Massimo Coccia, Elena Dell'Agnesse, Labadi Fadwa, Gianfranco Lizza, Sergio Marchisio, Stephane Rosiere, Fabienne (Charlotte) Orazie Vallino, Maria Paradiso, Piercarlo Rossi

2) *Social and Cultural Development Issues, and Policies:* Claudio Cerreti, Piercarlo Grimaldi, Ciro Isidoro, Mirella Loda, Claudio Minca, Antonio Palmisano, Lida Viganoni

3) *Natural Environment Issues and Policies for an Ecologically Sustainable Development, at regional and global scales:* Francesco Dramis (Coord.), Paolo Billi, Egidio Dansero, Paola Fredi, Marco Giardino, Giorgio Malacarne, Fausto Manes, Antonio Rolando, Fabienne (Charlotte) Orazie Vallino, Aldo Viarengo

4) *Regional and Urban Development Issues, and Planning Methodology:* Tullio D'Aponte, Vittorio Amato, Grazia Brunetta, Cesare Emanuel, Fabio Pollice, Vittorio Ruggiero, Franco Salvatori, Christian Vandermotten, Angioletta Voghera

5) *Issues of Business Development, Strategy, and Regional Economy:* Bjorn Asheim, Elio Borgonovi, Maura Campra, Vincenzo Capizzi, Stefano Caselli, Maurizio Comoli, Sergio Conti, Francesco Favotto, Giovanni Fraquelli, Gianfranco Rèbora, Mario Valletta, Peter Wiltshier

6) *Methodological and Technical Issues of Geographic Information and Spatial Analysis*: Margherita Azzari, Salvatore Amaduzzi, Maurizio Gibin, Andrea Favretto, Gianfranco Spinelli

7) *Energy Issues*: Federico Testa (ENEA), Riccardo Basosi (Siena), Sue Roaf (Edinburgh), George Gross (Urbana, Illinois), Marco C. Masoero (Torino), Patrizia Lombardi (Torino) and Emanuela Colombo (Milan).

Board of Referees

Professors, Researchers and Experts in the fields and specific topics of the manuscripts submitted for publication.

Headquarter of the Publishers: Geoprogess & DISEI-UPO, Via Perrone 18 – 28100 Novara; E-mail: 1) DISEI-UPO, stefania.albanese@uniupo.it 2) Geoprogess, info@geoprogess.eu

Table of contents

Editorial Note.....	9
---------------------	---

ARTICLES

1. Cities and Sustainable Urban Planning in Transition. <i>Antonella Romanelli</i>	13
2. Eco-Innovation in SMEs and Internationalization. <i>Valentina Battista, Caterina Nicolais</i>	27
3. Equity Matters. Financing the International Environment Fund (I.E.F.) through G7 SDRs quotas. <i>Gabriele Casano</i>	43

Editorial Note

2022 is in fact still a pandemic year for the GeoProgres Journal and the issues we publish contain only Articles, there are no Documents or other Columns relating to ongoing scientific debates. The pandemic has effectively reduced investigations and relationships outside one's own research center. Therefore, the number of articles proposed for publication has also decreased and even more those approved for publication.

The three articles in this first issue are, however, not only of a good standard in terms of social and scientific interests, but also representative of some of the research topics favored by this journal and by the association that publishes it.

The first, by Antonella Romanelli, considers cities, particularly some of the most urgent sustainability problems of their development (such as pollution, energy waste) and planning progress - a territorial governance tool that Geoprogress intends to promote, consistently with its Statute -. These topics have been the object, especially in recent years, of many scientific contributions from different disciplines, each of which favors some aspects over others. This article highlights that cities are playing a leading role towards sustainable development especially enabling citizens as responsible consumers and producers.

It could contribute to the development of a truly integrated approach to urban studies and planning, unfortunately still often dominated by a vision of the territory, typical of certain planners and geographers, which favors its physical aspects.

The paper of Valentina Battista and Caterina Nicolais also deals with sustainability considering the SMEs and specifically with eco-innovation which is, according to UNEP, «a new business approach which promotes sustainability throughout the entire life cycle of a product, while also boosting a company's performance and competitiveness. It can help small- and medium-sized enterprises (SMEs) access new and expanding markets, increase productivity, attract new investment into the business, increase profitability across the value chain, and help SMEs stay ahead of regulations and standards – notably those related to the environment. »

This paper investigates the effect of eco-innovation on internationalization of European SMEs, a relationship that does not seem to have been sufficiently analyzed. Moreover, using the Ordinary Least Square (OLS) method the research tries to ascertain whether eco-innovation policies have a positive impact on SMEs internationalization.

Development is not sustainable if sustainability is not global: no one, not even the most powerful or the smallest nation, can close its territory under a glass bell, to defend its climate and its natural resources and also its environment society from external changes and pressures. Sustainability is achieved with multiple interventions, especially local ones, which require non-scale policies and last but not least agreements between nations for the construction of a more balanced and equitable international ecological system.

The need for this new order, i.e. international rules and a regulatory tool which make it possible, is recalled in the third paper, by Gabriele Casano. The paper in fact gives a relevant contribution for updating the proposal of building the International Environment Fund (I.E.F.), intended as a

compensation fund and regulator of environmental balance between nations (proposal that I still consider essential, thirty years after the UN conference in Rio de Janeiro, where it received the opposition of the richest and most ecologically indebted countries). In particular the paper of G. Casano defines an important funding channel for the I.E.F., which could « guarantee its operativity in the long term and which - potentially - provides greater financial availability. Following the 2021 IMF's large-scale General Allocation, an almost unrepeatable opportunity has arisen for financing the I.E.F. through portions of SDRs quotas belonging to countries in debt in environmental terms, guaranteeing respect for the principle of equity and international justice. »

Francesco Adamo

ARTICLES

CITIES AND SUSTAINABLE URBAN PLANNING IN TRANSITION

Antonella Romanelli*

Abstract

Sustainable development is advancing through cities that contribute to reducing pollution and energy consumes, managing efficiently energy uses, and behave as drivers of urban sustainability by rethinking an approach to redesigning urban planning. Cities are transitioning towards urban sustainability, meeting the needs of communities without compromising the wealth of future generations. Cities are playing a leading role in advancing towards urban sustainability, designing and implementing urban planning that has a positive impact for urban and natural environments, leading to environmental, social and economic benefits within urban ecosystems, and enabling citizens as responsible consumers and agents of social change. The future of sustainable urban development relies on cities redesigning urban planning, making healthy and efficient energy-led urban spaces, encouraging behaviours and actions for clean energy production, zero waste and emissions' reduction, leading to urban sustainable energy transitions.

Keywords: urban planning, efficiency energy use, sustainable urban development and sustainability

1. Introduction

Demographic, environmental, economic and social transitions are leading cities to rethinking a renewal in models of urban development and urban planning. Cities are rethinking a strategic approach to urban planning, managing efficiently energy use and reducing energy consumption (Amado, Poggi and Amado, 2016), shaping energy-efficient and low-carbon cities (Cajot et al., 2017). Urban sustainability relates to how cities are able to recognize the human needs, managing limited resources, and absorbing the pressure of human activities (Alberti and Susskind, 1996), and meeting the long term needs of urban communities by managing the interactions between urban system and natural environment (Alberti, 1996). Energy efficient cities contribute to urban sustainability by redesigning urban planning in order to improve the living conditions of people and quality of life (Islam, 2011), facilitate sustainable urban energy transitions (Broto, 2017), and support energy efficiency systems and technologies (Amado, Poggi and Amado, 2016).

* Antonella Romanelli, Department of Business and Law, University of Naples Parthenope, Via G. Parisi, 13, 80132, Napoli. E-mail address: antonella.romanelli@uniparthenope.it

Improving urban energy sustainability enables cities to combat climate change, reducing greenhouse gas emissions, and promoting sustainable energy actions (Marquez-Ballestreros et al., 2019), ensuring livable spaces and clean environments to achieve urban sustainability in terms of preferable conditions that benefit urban communities (Hassan and Lee, 2015). Driving more green, responsible and sustainable behaviors is both a social and economic challenge that cities are facing in order to shape future healthy and wealthy communities and society where current projections indicate that two in every three people will live in urban areas by 2050. Managing municipal energy consumption is both a relevant aspect and theme of energy management and an issue of urban planning policies (Pereira and de Assis, 2013). Cities are sustaining consistent efforts to reduce emissions and mitigate long-term impacts on climate change (Yazdanie and Orehounig, 2021), designing energy efficient urban planning processes by minimizing the impact of new buildings and urban development areas (Loeffler, Österreicher and Stoeglehner, 2021). Planning urban energy efficiency policies and initiatives supports the efforts to reduce the impact of pollution and carbon emissions, enabling cities as engines of urban sustainability and environmental quality (Meijering, Tobi and Kern, 2018; Marquez-Ballestreros et al., 2019). It is time that cities aim to develop adequate urban planning policies by tailoring fit tools for energy services coherently with goals and purposes of urban energy planning (Ferrari, Zagarella, Caputo and Bonomolo, 2019) in order to ensure better quality of life for citizens, and to support people and business to assume responsible behaviors about energy use and consume, enabling innovative, green and sustainable urban communities. Today, cities aim to rethink sustainable urban planning policies, promoting a smart energy city development in order to achieve better quality of life (Mosannenzadeh et al., 2017). Sustainable urban development relies on meeting the needs of future generations. Promoting initiatives for driving sustainable urban development aims to do more with less, privileging an efficiency approach to managing energy use and consumption, reducing pollution and degradation of natural resources and promoting lifestyles, preserving the needs of future generations and communities (Amado, Poggi and Amado, 2016; Cajot et al., 2017). Cities are consuming three-quarters of the world's energy and causing three-quarters of global pollution. As communities living within urban spaces, cities are becoming responsible actors for addressing more sustainable and efficient energy use. Cities may support consistent efforts in reducing urban pollution and addressing a pathway for sustainable and high quality of life (Jayne, 2006). Cities are rethinking the urban future planning and driving effective urban social and economic change and innovation (Bourne, 1971). Cities track a pathway to achieve urban sustainability, focusing on the environmental dimension of urban sustainability, managing efficiently energy consumption (Meijering, Tobi and Kern, 2018), reducing energy consumption, promoting efficient energy use and renewable energies (Hassan and Lee, 2015). Urban planning is considered as a means to enhance sustainable development within urban communities and spaces. Managing energy efficiency relies on rediscovering the urban scale. Cities are rethinking urban planning choices beyond the dominant approaches that focus on efficiency energy at local scale (Amado, Poggi and Amado, 2016). Designing urban planning shapes healthy urban spaces where people, groups, agents of sustainable urban development, cities are planning healthy urban places, promoting efficiency of energy use and consume (Satterwaithe, 1997) in order to reduce the negative externalities and contribute to quality of life, improving urban

ecosystems (Yigitcanlar and Teriman, 2015) coherently with the ambition to shape a green, renewable source use-led society and economy (European Commission, 2019). Cities are designing sustainable urban planning in order to achieve social, environmental and economic goals (Islam, 2011), reducing negative environmental impacts, shaping energy efficiency, overcoming the obstacles that hinder sustainable urban transitions, fostering cleaner production and better urban design (Puchol-Salort et al., 2021; Cajot et al., 2017; Li, Beeton, Sigler and Halog, 2016), developing renewable energy and improving urban eco-efficiency for a multi-dimensional change of urban spaces (Hens, 2010; McCormick, Anderberg, Coenen and Neij, 2013).

The key to unlock the door of sustainability is the city. As safe and resilient human settlements, cities are transitioning to the sustainable city which is able to build human settlements, minimizing the environmental impact and damage within urban areas, integrating social and economic development, environmental management and urban governance. Focusing on the cities supports the efforts for achieving sustainable economy and planet. As spaces of energy use and consumption, cities are the main drivers and *influencers* of responsible sustainable behaviors. There are still few studies that elucidate the role and task of cities in promoting sustainable urban planning by enabling wealthy urban environments, and rethinking current urban planning policies, approaches and practices in order to achieve energy use and consumption efficiency and good management of energy by renewable sources (Amado, Poggi and Amado, 2016). The aim of the paper is to elucidate how cities are rethinking how to redesign a sustainable urban planning, enabling a pathway for addressing urban transformations and transitions to urban sustainability, playing a strategic role in designing urban environments that support the efforts for advancing sustainable lifestyles and energy use and consumption. Today, cities are rethinking strategy and policies about urban planning, designing a strategic renewal towards a sustainable vision, by managing efficiently renewable sources, reducing pollution and degradation. In Italy, cities are designing and implementing the *PAESC (Action plan for sustainable energy)* coherently with Covenant of Majors for Climate and Energy, in relation to the objectives set by the Italian *PNIEC (Piano Nazionale per l'Energia e il Clima)* and emerging within *The European Green Deal*. This study relies on analysis of documentation about a case study on urban planning initiatives with regards to Mantova *PAESC* in which the re-design of urban planning helps the city to rethink the future of urban social ecosystems and spaces in transitioning to sustainable, efficient, and green pathways that drive the city into a healthy future. Selecting the case study of Mantova urban planning drives the readers to understand the pathway of urban sustainable and efficient energy urban transition within a city which is rethinking the urban potential in terms of energy efficiency and environmental degradation reduction, redesigning urban spaces, bringing together both the historical and cultural vocation and the productive one, shaping livable, healthy and resilient urban spaces, working for reducing pollution and wastes by efficiently managing energy use and consumption. The case study related to the redesign of Mantova urban planning is relevant because it refers to a municipality which is rethinking the future urban development bridging both productive and industrial activities and historical and cultural vocation of the urban territory, in order to make all the human activities as

sustainable and coherent with needs of people and resources from the ecosphere and environment. This case study refers to an urban planning redesign that focuses on efficiency energy use and aims to make sustainable productive and cultural activities that contribute to the urban value and health of the territory. The remainder of the study is structured as follows. After the introduction, in the second section the methodology section is briefly presented. In the third section, theoretical background is elucidated. In particular, as communities advancing for sustainable urban development, cities are redesigning urban planning policies for achieving the goal of sustainable energy efficiency and consumption. In the fourth section, the case study related to Mantova urban planning about energy efficiency use and consume is presented. The main issues and initiatives of Mantova *PAESC* urban planning are reported and described. Finally, conclusions are set out.

2. Methodological section

This study is qualitative, exploratory and descriptive. Methodology relies on a single case study's analysis related to the urban planning design and policies structured within the Italian city of Mantova. The case of Mantova *PAESC* related to urban planning redesign is reported and described. The case study related to Mantova urban planning redesign is relevant because it refers to a municipality which is rethinking the future urban development bridging both productive and industrial activities and historical and cultural vocation of the urban territory, combining economy and environment as a sustainable bridge by driving responsible behaviours in energy use and consumption towards a respectful and sustainable transition. In the case study the municipality is rethinking about sustainable urban future of the city, designing urban planning policies that focus on making efficient and sustainable energy use and consumption. A case study view provides a comprehensive understanding of the phenomenon without the rigidity of a predefined structure for observations and analysis (Yin, 2009). Specifically, with regards to studies on urban planning and sustainability the methodology based on case studies refers to research concerning the policies and initiatives that city aim to define and implement in order to drive the transition toward urban sustainability and design of urban spaces for a minimal impact on natural environment (Li, Beeton, Sigler and Halog, 2016; Loeffler, Österreicher and Stoglehner, 2021), using analytical tools to select satisfying solutions to improve energy efficiency, use and consume from a both economic and environmental view, by policy decisions that pay attention to energy availability in terms of impact on pollution (Sampaio, Dias and Balestrieri, 2013). As drivers of sustainable development, cities improve urban energy sustainability, reducing environmental impact, increasing clean energy sources use and energy efficiency and access, and incentivising planning for sustainability (Marquez-Ballestreros et al., 2019). Designing urban energy planning supports urban energy transitions within changing urban environments, and open to sustainability trajectories coherent with city-specific conditions (Broto, 2017).

3. Theoretical background

3.1 The role of cities for achieving sustainable urban development

Today, the challenge is to make the city as an agent and driver of sustainable urban development (Satterwaithe, 1997). As cities provide opportunities for using more efficiently resources, the way of managing cities affects urban sustainability (Alberti and Susskind, 1996). Cities are redesigning urban planning and formulating equitable strategies to ensure the highest quality of life, and the efficient use of natural resources, supporting sustainable consumption and production patterns, reducing greenhouse gas emissions in order to achieve the sustainable management and efficient use of natural resources, and taking urgent actions to combat climate change and its impact (United Nations, 2015). Cities contribute to the ecological and social function of land, fostering a sustainable transition to green deal and production (United Nations, 2017), identifying a sustainable way to address green transition towards responsible consumers' behaviors, making resilient and sustainable human settlements and urban communities (European Commission, 2020).

Sustainable development refers to capacity to meet the needs of the present generation by preventing and reducing environmental pollution, breaking the linkage between economic growth and environmental degradation (Council of the European Union, 2006). The city «is an organized system of many interacting biophysical and socioeconomic components and that the system itself affects the level of pressure that individuals exert» (Alberti, 1996, p. 387). Sustainable urban development relies on cities that are responsible for the impact they have on global scale (Alberti and Susskind, 1996), driving the transition into sustainability by managing efficiently energy use and consumption, and reducing emissions (Hassan and Lee, 2015).

Cities aim to achieve sustainable urban development in order to improve the quality of life and well-being of people, meeting the needs of future generations (Islam, 2011), redesigning urban planning policies, and rethinking on sustainable and environmental choices (Nash, 2009), making an efficient use of all natural resources, implementing sustainability-led policies to prevent undermining improvements in the production efficiency, achieving sustainable lifestyles about energy use and consumption, increasing efficiency resource management (Norwegian Ministry of Environment, 1995).

Promoting sustainable urban development relies on addressing social and economic growth, enabling the capacity of social urban ecosystems to decouple economic growth from environmental degradation, improving the environmental and social performances for products and processes in order to enhance human wealth, and prosperity, shaping a long-term scenario for healthy urban future, doing more and better, with less. Today, the challenge is to integrate the sustainability-led practices in the patterns of producing and consuming efficiently energy, influencing on global warming, pollution and natural resource depletion, driving towards smarter consumption and production, making green activities and supply chains (European Commission, 2008).

3.2 Cities re-designing urban planning for sustainable energy efficiency and consumption

Cities contribute to urban sustainability, improving efficient energy use and consumption, bridging energy planning and urban planning to achieve sustainability issues (Cajot et al., 2017). Cities are dealing with sustainability as opportunity, reinvention, process and coherent choices by managing their impact on the environment. Improving efficient energy use and consumption supports cities in transition to sustainability self-reliant cities that are, learning and modifying their behaviors in response do environmental change to preserve the *urban ecological space* on which a city depends to meet the needs of its inhabitants (Alberti, 1996), and driving energy planning facilitates an urban energy transition towards sustainability, and urban sustainability trajectories depend on city-specific conditions (Broto, 2017). Rethinking urban planning helps cities to shape sustainable and healthy urban spaces, tracking a pathway to achieve urban sustainability in order to reduce electricity consumption, managing efficiently energy consumes, promoting adequate urban planning practices, integrating the energy consumption reduction with obtaining energy from renewable sources, redesigning the ecological and efficient energy vocation of urban areas (Amado, Poggi and Amado, 2016), developing smart energy solutions (Mosannenzadeh et al., 2017). The search for urban sustainability is becoming a core issue in the debate on urban policy and strategy. The future of cities as urban communities should be safe, healthy and sustainable. Sustainable urban development is seen as a means to reduce the negative impact and externalities realized by human activities on the environment, to contribute to urban ecosystems' improvement and better quality of life (Yigitcanlar and Teriman 2015). Sustainable urban planning relies on community participation and involvement of all stakeholders, and coordination among different levels of planning. Sustainable urban planning focuses both on controlling land use and policies and means of implementation that contribute to achieving social, environmental and economic goals (Islam, 2011).

Actually, the city is a complex social and economic system under stress in virtue of unsustainable urban development paradigms based on ever-increasing consumption of resources. The city of tomorrow has to assume a circular pathway and metabolism with regards to the transformation of inputs in outputs to reduce gas and make greenhouse. In the 21st century the sustainability-led urban challenge relies on cleaner, greener and carbon-neutral cities that aim to promote initiatives for developing renewable energy, improving urban eco-efficiency, dealing with climate change, urbanization and resource depletion (Hens, 2010). Cities may actively contribute to reducing emissions (Yazdanie and Orehounig, 2021), designing urban energy planning, driving sustainable urban transformation in order to develop a multi-dimensional change of urban areas (McCormick, Anderberg, Coenen and Neij, 2013).

Energy efficient cities contribute to meeting economic, social and environmental challenges (Amado, Poggi and Amado, 2016). Cities have to redefine and implement urban planning systems in order to promote sustainable urban design and development in response to climate emergency and population growth, minimizing pressures on natural environments and urban infrastructures (Puchol-Salort *et al.*, 2021). Cities may actively design urban planning to achieve urban energy targets and shape energy efficient, low carbon urban spaces even if obstacles and challenges influence efficient urban energy planning (Cajot et al., 2017). Improved planning and regulation help cities to drive the transition towards urban sustainability by fostering cleaner production and better urban design, reducing negative environmental impacts (Li, Beeton, Sigler and Halog, 2016).

As redesigning the innovative potential of urban areas in terms of renewable energy sources, cities aim to promote the renewal of lifestyles and transformation, leading to sustainable urban transitions, driving changes in production and consumption patterns (Ernst, De Graaf, Peek and Loorback, 2015), empowering citizens, business and communities to assume responsible consumption and lifestyles behaviors (Clarke, 1997). Post-industrial and post-modern cities are redesigning urban planning, enabling people to assume responsible consumption behaviors, supporting businesses and industries to move to more resource-efficient production processes, adopting more sustainable supply chain management. Sustainable urban transformation relies on cities as privileged places and key drivers of urban planning redesign, by formulating policies for incentivizing environmentally preferable behaviors, encouraging business to transform their practices for reuse and zero waste (Lehmann, 2012), and contribute to social and economic development, and public wealth (O'Brien, 1999; Yagi and Kkubu, 2020). As cities become *mobilizers* of social capital for sustainable lifestyles and social changes, encouraging responsible behaviors about consumption, municipalities have to redefine *ad hoc* policies in order to revitalize the urban environments in a sustainable way, facilitating the rise of smart behaviors about consumption, and encouraging bottom-up initiatives (Moll et al., 2005). As resilient communities, cities are re-engineering the urban spaces, enabling citizens as energy producers as well as consumers, developing responsible consumption patterns (Schröder et al., 2019).

4. Rethinking urban planning for sustainability. The Mantova PAESC

The municipality of Mantova aims to drive urban and territorial change, defining a strategy based on emission reduction and adaptation to effects of global warming, designing urban energy planning relying on reducing land consumption, fostering sustainable mobility, making energy-efficient buildings, and support renewable energies. The BEI or Baseline Emission Inventory has been conceived to monitor the emissions with regards to year 2005. In the Mantova PAES the inventory BEI 2005 refers to consumptions and emissions due to final energy uses and to the production of energy with regards to key strategic sectors (public buildings and illumination, vehicles, urban transportation, private building and services) in relations to future challenges concerning the urban environment of Mantova. In 2005 the energy context refers to a territory where the urban structure involves both historical and architectonic elements and productive and economic areas related to chemical and industrial pole. It was the information basis that enabled the municipality to set the objectives for reduction of emissions in 2020 and for 2030. In the Mantova PAES (*Piano d'Azione per l'Energia Sostenibile*) as a picture of consumptions and emissions due to final energy uses and to the production of energy within the territory of Mantova, the inventory BEI 2005 helped to address the objectives for reduction of emissions in 2020 and for 2030. The energy context in Mantova refers to a territory where the urban structure concerns both the historical center and productive areas where chemistry and industrial poles, and a thermoelectric plant are involved. In 2005, the most part of emissions (49%) is related to the activities of the productive sector. Natural gas (45%)

and electric energy (40%) contribute to the emissions in virtue of chemical industry that requires high heat and electric consumes. In 2005 the energy consumes in the municipal territory of Mantova regard 1.588.074 MWh /year and concern 411.257 tons/CO₂.

In 2019 the municipality of Mantova had performed the second monitoring report by *PAES* (Full reporting), set the update of actions and, formulated a new inventory of emissions with regard to the year 2017: the MEI 2017-Monitoring Emission Inventory as the second monitoring report. Population living in Mantova increased (+4% in the 2017 in comparison with 2005). The socio-economic and territorial ecosystem relies on Mincio river and lakes' system within Mincio park and important touristic attractors and drivers jointly with urban cultural heritage. In 2016 productive and economic activities related to chemical and industrial pole are still a relevant economic and social reality for Mantova and its county. In 2017 all the energy consumes (the industrial one included) concern 841.406 MWh/year and amount to 220.333 tons/year of CO₂. The most part of municipal emissions (the 61% as distributed between 29% of residential one and 32% of services one) are attributed to the civil sector. With regards to the percentage of emissions, the productive sector (27%) and transportation sector (11%) follow. Only 1,5% the emissions referred to public administration. Natural gas and electric energy are the main drivers of the emissions. The role of electric energy in causing emissions is increasing (46%). In the period 2005-2017 a diminishing trend of consumes and CO₂ emissions is occurring in relation to both efficiency actions and responsible behaviors of industrial sector's actors in reducing energy consumes, pollution and emissions.

As engines of environmental quality driving a respectful transition for all citizens and planet's natural resources, cities are rethinking urban energy efficiency planning o reduce the impact of pollution and carbon emissions and minimize the impact of urban activities on the territory (Meijering, Tobi and Kern, 2018; Marquez-Ballestreros et al., 2019; Loeffler, Österreicher and Stoeglehner, 2021). The initiative set by the municipality of Mantova are coherent with following an urban planning approach aiming to reduce emissions and mitigate long-term impacts on climate change (Yazdanie and Orehounig, 2021).

Climate change, reduction of CO₂ emissions, and energy efficiency are the driving themes that are leading cities to rethinking urban planning approaches, policies and strategies. The city of Mantova is redesigning urban planning in relation to the objectives of the Italian *PNIEC* (*Piano Nazionale per l'Energia e il Clima*) in terms of transitioning to energy renewable sources, efficiency and security, innovation and research, and coherently with the ambition of the *European Green Deal* to enable national, regional and local public and private actors and communities to re-define and implement a growth strategy in order to transform prosperous societies, by promoting modern, resource-efficient, green, renewable source use and competitive economies.

In 2013 the municipality of Mantova has adhered to the Covenant of Mayors – Europe for climate and energy movement (which aims to make decarbonized cities able to use energy sustainable, to reduce greenhouse gas emissions on their territories, increase resilience to negative impacts of climate change and drive clean and sustainable energy transition towards a fairer, climate-neutral Europe for all) and approved the *PAES* (*Piano d'Azione per l'Energia Sostenibile*) in order to achieve the goal of reducing CO₂ (20%) emissions in 2020.

In the following years, after Mantova and neighborhoods municipalities have built a sharing energy urban planning, designing a *JOINT PAES*, monitoring actions (Action e Full reporting), a new inventory of consumptions and emissions has been designed. In 2018 the municipality of Mantova has defined guidelines for climate adaptation of the city of Mantova in order to help the city to prevent and effectively manage the impact of climate changes. In 2019 February, the municipality of Mantova, has renewed its commitment to Covenant of Majors for Energy and Climate, combining CO₂ mitigation and climate adaptation in order to reduce the degree of global media temperature, making urban spaces and territories as safe and resilient urban places. The objectives are the following ones: reducing (40%) the CO₂ emissions by 2030 with regards to the year of reference (Baseline Emission Inventory-BEI), integrating both the mitigation strategy and climate change adaptation strategy.

The objective is to reduce the emissions drawn by some sectors that are strategic in relation to future challenges: public building assets, public illumination, car fleet, private buildings, urban transportation, and services industry. Some scenarios for 2030 are hypothesized and the actions of Mantova municipality are set. With regards to improvement of public buildings it is necessary to improve the efficiency of public buildings, requalifying the buildings by promoting the transition from consumption of fossil sources to the consumption of electric energy locally produced by renewable sources or to the consumption of heat by thermal heating, using heat pumps by power supply. The actions of the municipality regard: progressive energy efficiency of buildings; the adoption of monitoring tools for electric and thermic consumptions; the implementation of pilot projects for citizenship; introducing criteria that favor the reduction of the emissions by providers within public contracts.

The goal of Mantova *PAESC* (2020) is to identify the optimal mix of initiatives in terms of actions and tools that may ensure the development of an energy, sustainable and efficient system that has the potential to make increasingly the territory, the urban environment and communities as resilient to uncertainties due to climate change. In particular, there are some priorities to be defined and implemented. Improving the energy saving and reinforcing the use of renewable energy sources enable the reduction of the energy needs and CO₂ emissions; promoting the conditions for developing current circular economy coherently with social and economic specific territorial and local traditions; understanding the critical aspects that regard both the sustainability and resiliency of the territory. Planning adequate initiatives and actions for climate change, emissions' reduction and energy saving relies on engaging and involving local stakeholders in the territory, and designing integrated and multi-sector strategies, policies and programs. The strategic objectives of Mantova *PAESC* are the following ones: mitigating CO₂ and reducing the emissions about the 40% by promoting systems of zero impact sustainable mobility; creating a climate monitoring network in the territory as integrated to regional systems and the control of environmental risk factors.

Implementing the *PAESC* implies three steps: involving both the governing bodies and the administrative offices of the municipality; engaging the main local stakeholders of several productive sectors working in territory as solutions takers and beneficiaries of the actions implemented by policies and initiatives set; fostering participation in the

setting of actions, identifying costs, times, and cultural and normative barriers that influence the implementation of the initiatives. In particular, empowering the local stakeholders to actively develop initiatives active participation of the stakeholders is a key aspect with regards to strategies and policies that set initiatives to mitigate the impact of climate change.

With regards to the public lighting, the municipality designed and implemented energy requalification plans in virtue of technological innovation processes and rationalization of consumptions in the period 2014-2018 by installing smart street lamps that drive the city into the future following a smart view and offer video surveillance, environmental and air monitoring, car traffic and parking check, WI-FI connection, and tools for recharging electric vehicles. The objectives for 2030 are: accelerating the efficiency management of public street lamps; providing new territorial services through smart street lamps by gathering data and information for municipal urban planning and for offering new services to the citizenry.

In 2017 the impact of industries and productive sectors with regards to the reduction of emissions (26%) and energy uses is diminishing (27%). By involving the actors of industries and productive services in sustainable urban planning, cities contribute to reducing the energy consumes in the territory. It is necessary to accelerate the efficiency energy transition and requalification of building to NZEB (Nearly Zero Energy Building) or Zero Emissions. The scenarios for 2030 are: driving the transition from the consume of electric energy by fossil sources to renewable sources; supporting the local production by energy renewable sources; reducing emissions and wastes, electric energy consumes; monitoring the energy consumes. The actions of Mantova's municipality concern: implementing the *Benefit Project* as a pilot project to support urban regeneration (*Piano strategico Mantova Hub/Strategic Planning Mantova Hub*); involving proactively the stakeholders in order to support efficiency energy projects, and engaging the *Soprintendenza* (Superintendence of cultural heritage) in order to plan initiatives that jointly concern energy efficiency of historical-cultural buildings.

In Mantova the impact of transportation concerns energy uses (12%) and CO2 emissions (11%). Energy consumes, urban and infrastructural, economic and social aspects are critical elements for an efficient public transportation management. The scenario 2030 concerns: implementing electric infrastructures (tram, trolley bus) for public transportation; implementing refueling renewable sources, and installations for public and private transportation; developing electric energy refueling sites; encouraging the diffusion of low environmental impact and electric energy-led vehicles; reducing private car mobility, incentivizing cycling and walking, car sharing and bike sharing mobility, by developing the inter-modality, and reducing the road transport by promoting railway, fluvial, maritime transportation. The municipality's initiatives concern: the electrification of municipality's cars; implementing the infrastructures for sustainable mobility; reducing the private cars traffic, avoiding the circulation of vehicles that cause pollution; increasing the road security in order to foster the active mobility; promoting mobility management actions for home-school and home-office moving, integrating sustainable mobility services (car and bike sharing near bus stations and railway); better ensuring the links between parking and historical center through shuttles; redesigning the organization of public transportation, empowering the infrastructure for goods transport on railway or by sea. With regards to the local production of electric energy, the municipality is planning initiatives for sustainable production of energy by using renewable sources. Since 2017

photovoltaic systems (8,8 MWp), hydroelectric systems (313KWe), and a biogas system (635 KWe) are installed. The scenario 2030 concerns: an increase in the electric energy production from renewable sources by self-consumption regime or through the actions of energy communities; increasing the energy self-sufficiency of buildings and limiting the exchanges with public electric connection; distributed generation of electric energy and development of smart grid. The municipality is planning some coherent actions in relation to the future scenario: building photovoltaic installation on public buildings or buying green energy to cover electric consumes; designing permanent mechanisms of communication and coordination municipality-superintendence of cultural heritage in order to identify actions that contribute both to ensure electric energy production from energy renewable sources and protect the historical and cultural value of sites within historical center; adopting regulations to encourage of electric energy production in sustainable modes coherently with urban planning setting.

4. Conclusions

Cities are developing energy urban planning to drive communities towards urban sustainability. Designing sustainable urban energy planning is leading cities to shape a healthy urban future for social and economic growth and innovation, preserving natural environments, defining guidelines, initiatives and actions to reduce pollution, CO₂ emissions, promoting energy efficiency use and consume, and decoupling economic growth from environmental degradation. This study aimed to elucidate the role of cities as key players for addressing sustainable urban transitions and transformations by designing urban planning for sustainable urban wealth, leading to responsible consumption and production, and to efficiency management in energy use and consume. The findings of this research shed light on a case study of a city which is redesigning urban planning in the attempt to preserve energy efficiency use and consumption, advancing the patterns of producing and consuming in a sustainable way in order to achieve urban sustainability. Furthermore, promoting sustainable and responsible consumption and lifestyles relies on proactive engagement and participation of citizens and local stakeholders in the decision-making processes, leading to sustainable consumption patterns that have favorable benefits for communities and society. Cities have to develop effective urban planning frameworks to encourage changes in urban consumption behaviors, to support emissions' reduction, encouraging citizens and business to become aware and responsible consumers who pay attention to common wealth, spreading sustainability patterns, and avoiding the increase of pollution and environmental degradation. In conclusion, the future of sustainable urban development relies on cities promoting effective urban planning in order to drive social and economic growth of urban areas, making healthy urban spaces. Future research perspectives rely on investigating case studies within Italian cities' planning initiatives for improving urban sustainability, dealing with sustainable consumption and production, searching for a dialogue and cooperation with citizenry and industry.

5. References

Actionaid (2010, February). Using Special Drawing Rights for Climate Finance. *A Discussion Paper*.

Adamo F. (2017). The International Environment Fund (IEF), for sustainable energy and social progress for all. *GeoProgress Journal*, 4(1).

Andrews D. (2021). Reallocating SDRs to Multilateral Development Banks or other Prescribed Holders of SDRs. *Center for Global Development*.

Aryeetey E. (2004). A Development-Focused Allocation of the Special Drawing Rights. In A. B. Atkinson, *New Sources of Development Finance*. Oxford University Press.

Bassetti F. (2019, October 29). *The cruel irony of climate debt. Foresight: the CMCC observatory on climate policies and futures*. Taken from <https://www.climateforesight.eu/migrations-inequalities/the-cruel-irony-of-climate-debt/>.

Bredenkamp H., Pattillo C. (2010, March 25). Financing the Response to Climate Change. *IMF Staff Position Note*.

Casano G. (2022). Next Generation Africa: which opportunities and challenges in the definition of a new instrument reallocating european SDRs to the African continent. *Perspectives on Federalism*, 14(1), 44-63.

Chancel L. (s.d.). Climate change & the global inequality of carbon emissions, 1990-2020. *World Inequality Lab*.

Chowdhury A., Jomo S. K. (2022). The Climate Finance Conundrum. *Development*, 65, 29-41.

ECA (2022, June). *Launch of the Liquidity and Sustainability Facility*. Taken from <https://www.uneca.org/events/launch-of-the-liquidity-and-sustainability-facility>.

ECA-ECLAC (2022, April). Special Drawing Rights (SDRs) and the COVID-19 crisis. *COVID-19 Report*.

Eckstein D., Künzel V., Schäfer L. (2022). *Global Climate Risk Index 2021. Who Suffers Most from Extreme Weather Events? Weather-Related Loss Events in 2019 and 2000-2019*. Germanwatch.

Financial Times (2018, July 03). *Climate challenge vulnerable countries take higher debt payment hit*. Taken from <https://www.proquest.com/newspapers/climate-challenge-vulnerable-countries-take/docview/2081903684/se-2?accountid=15964>.

Flor E. (2019). *SDR: From Bretton Woods to a World Currency*. Peter Lang.

Georgieva, K., Tshisekedi, F. (2021, December 17). Africa Cannot Confront Climate Change Alone. *Project Syndicate*. Taken from <https://www.project-syndicate.org/commentary/supporting-climate-adaptation-in-africa-by-kristalina-georgieva-and-felix-tshisekedi-2021-12>.

IMF (2017, October). *World Economic Outlook 2017. Seeking Sustainable Growth: Short-Term Recovery, Long-Term Challenges*. Taken from <https://www.imf.org/en/Publications/WEO/Issues/2017/09/19/world-economic-outlook-october-2017#Chapter%203>.

IMF (2022, June). *Climate Change Dashboard - Financial and Risk Indicators*. Taken from <https://climatedata.imf.org/pages/fi-indicators>.

IMF (2022, May). *Factsheet - Special Drawing Rights (SDR)*. Taken from <https://www.imf.org/en/About/Factsheets/Sheets/2016/08/01/14/51/Special-Drawing-Right-SDR>.

IMF (2022, June). *Special Drawing Rights (SDRs)*. Taken from <https://www.imf.org/en/Topics/special-drawing-right>.

Imperial College Business School and SOAS University of London (2018). *Climate Change and the Cost of Capital in Developing Countries (Executive Report)*.

IPCC (2022). *Impacts, Adaptation and Vulnerability. Summary for Policymakers*. Taken from https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicSummary.pdf.

Jensen L. (2021, June). An Unprecedented Opportunity to Boost Finance for Development - The Upcoming Special Drawing Rights Allocation. *UNDP Global Policy Network Brief*.

Masini F. (2022). Time for a Next Generation Africa. *Perspectives on Federalism*, 14(1), 1-12.

Matustík J., Kocí V. (2020). What is a footprint? A conceptual analysis of environmental footprint, *Journal of Cleaner Production*.

OECD (2021, September). *Climate finance provided and mobilised by developed countries: Aggregate trends updated with 2019 data*. Taken from https://www.oecd-ilibrary.org/finance-and-investment/climate-finance-provided-and-mobilised-by-developed-countries-aggregate-trends-updated-with-2019-data_03590fb7-en.

Persaud A. (2021, November). *Saving Paris: An economically efficient and equitable rescue plan*. Taken from VoxEU (CEPR's policy portal): <https://voxeu.org/article/saving-paris-economically-efficient-and-equitable-rescue-plan>.

Plant M. (2021). The Challenge of Reallocating SDRs: A Primer. *Center for Global Development*.

Triffin R. (1968). *Our international monetary system; yesterday, today, and tomorrow*. New York: Random House.

UNFCCC (2022, May). *Introduction to Climate Finance*. Taken from <https://unfccc.int/topics/climate-finance/the-big-picture/introduction-to-climate-finance>.

Viterbo A. (2021, November). The 2021 IMF Allocation of Special Drawing Rights: Too Little, Too Late and Too Unequal. *Osservatorio sulle attività delle organizzazioni internazionali e sovranazionali, universali e regionali, sui temi di interesse della politica estera italiana*.

Wackernagel M., Beyers, B. (2019). *Ecological Footprint. Managing Our Biocapacity Budget*. Global Footprint Network.

WIB (2022, May). *World Inequality Bank*. Taken from <https://wid.world/>

ECO-INNOVATION IN SMEs AND INTERNATIONALIZATION

Valentina Battista

Caterina Nicolais*

Abstract

Eco-innovation combines several academic and business issues, including a global interest in the significant impact over international economies. SMEs play a critical role because specific actions on their products and services can primarily reduce resource waste. However, the effect of eco-innovation on internationalization has gained insufficient consideration. This paper seeks to fill this gap by investigating the effect of eco-innovation on internationalization of European SMEs. Moreover, the research tries to ascertain whether eco-innovation policies have a positive impact on SMEs internationalization. In order to do so, the Ordinary Least Square (OLS) method has been used and the results show that the eco-innovation drivers (investments in research and development, green patents and expenditure in green technology products) reveals a positive relationship on SMEs internationalization and the role of collaboration on technology appears to positively moderates the hypothesis of the study.

Keywords: eco-innovation; eco-innovation policies; SMEs; green patents

1. Introduction

In recent years, eco-innovation has generated many interests in both the academic and business world. Due to the growing problems concerning the environment, such as the scarcity of primary resources and the increase of the population, the preservation of the quality of the environment has become increasingly crucial, as also emphasized by Govindan et al. (2017). In addition, resource management, pollution control and climate change are all problems, which by their nature go beyond domestic geographical boundaries and take on an increasingly important international dimension. This entails a significant influence on the national and global economy, placing sustainability challenges at the center of the world debate and considering them a priority. According to this perspective, interest in eco-innovation has become one of the priorities in both the academic and business world. According to Fussler and James

* Valentina Battista, PhD Candidate in international PhD program in Economics and Management of Sustainability and Innovation at LUM University, e-mail: battista.phdstudent@lum.it; Caterina Nicolais, Researcher in Economic and political geography at the University of Naples "Parthenope", Department of Economic and Legal Studies, e-mail: caterina.nicolais@uniparthenope.it

(1996), eco-innovation refers to "new products and processes that provide value to the customer and the business, but significantly reduce environmental impacts".

As shown by the data of a recent report drawn up by the OECD (2020), the SMEs are among the greatest exploiters of resources and generators of significant waste, consuming about a third of the world's energy. Therefore, they represent a potential driver for creating an increasingly sustainable society and improving internationalization processes.

The aim of this study is to investigate the effects of eco-innovation on the internationalization of SMEs. Eco-innovation, as Wagner and Lerena (2011) pointed out, is a branch of innovation in economics and is defined as the "production, or exploitation of a good, a service, a production process or a new business, the results of which led to a reduction in environmental risks, deriving from the exploitation of resources compared to other relevant alternatives" (Kemp and Pearsons, 2007). Similarly, the Eco-innovation Observatory has defined eco-innovation as an innovation that reduces natural resources and decreases harmful substances in the life cycle of processes. Eco-innovation is therefore identified as the bearer of solutions that are environmentally friendly compared to alternative innovations. Furthermore, according to various scholars, eco-innovation offers opportunities to open new business channels by providing SMEs with a competitive advantage, leading to a favorable, win-win situation for the environment and SMEs; (Horbach, 2016). To contribute to the literature, the research question is: what is the effect of eco-innovation on SMEs internationalization? Moreover, what are the moderating effects of technological cooperation in the field of eco-innovation? To answer the research question and validate the hypotheses, a quantitative analysis was conducted through an OLS model. The paper data collection was carried out on Eurostat, the national statistical offices and the DIW Econ database on innovation and internationalization of SMEs and the Annual Report on European SMEs 2018/2019; (EC-European Commission (2019). The analysis was conducted on a dataset containing information about the eco-innovative activities of SMEs belonging to the ten European countries that have distinguished themselves in the field of eco-innovation. This research shows the positive effects of eco-innovation on the internationalization of SMEs, confirming the fundamental role assumed by government policies and the technological cooperation. The paper is organized in an overview from the literature concerning the international theory, the conceptual framework and the methodology description. Next, the econometric model and the results are presented and discussed.

2. Theoretical Background: The Internationalization Theory

Over the past decades, man-made pollution, the scarcity of natural resources, the enormous production of waste and its disposal have become subjects widely debated and analyzed at global level. Above all, the emissions of pollutants responsible for the intensification of harmful greenhouse gases, which lead to the consequent increase in global warming, are a source of concern. It has been found that these gases have become more acute with the progress of human activities. The consequences of these phenomena are seen every day in climate change, which brutally modifies the natural balance of our planet. According to the Organization for Economic Cooperation and Development forecasts, the world population will exceed 9 billion inhabitants by 2050.

On the one hand, this will lead to the need to increase the production of necessities and others. Faced with this compromise, various actors, including businesses, governments, and consumers, are called upon to react with a certain urgency. Thus SMEs, aware of the importance of their social responsibility in the face of the problem of pollution as well as of the need to evolve in the face of changes the needs of their customers and stakeholders, must increasingly take into account social and environmental issues when developing new products; therefore, trying to pursue both economic and environmental goals. Within this globalized and increasingly interdependent context, SMEs are increasingly engaged in activities outside their internal markets. The literature and scholars such as Papadopoulos and Martin (2010) have identified these processes with different terms and among them internationalization, degree of internationalization and multinationality. But these reflections have been characterized by a minimum common denominator deriving not only from the possibility of creating value for SMEs but from the great situation of uncertainty that a process such as internationalization entails at the operational level, as underlined by Hitt et al. (2006). According to the theory of internationalization, this allows SMEs to take advantage of more effective use of resources and capacities in research and development and of resources to seize the opportunity to divide into costs with the consequent possibility of growth. Precisely in this context, the SMEs interfaces with what is defined in the literature as being responsible for extraneousness, referring to the expenses concerning non-traditional operations in the context of foreign and unfamiliar markets. The literature has investigated the drivers of the internationalization of SMEs, as underlined by Casson and Buckley (1976). What emerged in the literature is that in order to face the non-domestic market, grow and compete, SMEs must focus on their peculiarities and make them a strategy. These drivers are mainly linked to skills such as that research and development spending, the ability to innovate, SMEs innovations, the ability to collaborate with other SMEs, the size of the company and the governance. Unlike the two great theorists of internationalization, Casson and Buckley (2009), who focus their studies on transaction costs and imperfections on the middle market and the importance of research, Hymer (1968), focuses on the opportunities deriving from monopolies. The position of the two theorists of internationalization is also supported by Cerrato and Piva (2012) when they address in their studies the importance and the competitive advantage deriving from the exploitation of intangible assets beyond national borders with interest in the Uppsala model of Johanson and Vahlne (2017), which underline the importance of experience as a driving force of internationalization processes. According to Porter and van der Linde (1995), the international SMEs that appear to have achieved international success is characterized by a high rate of innovation and high levels of research and development. For these reasons, many scholars have investigated the role and link between internationalization and green innovation, focusing on the fundamental role of research. According to the literature, product and process innovations are distinguished and allow SMEs to be highly competitive in the foreign market. Furthermore, this ability of SMEs, is related to the ability to use not only their internal know-how but also to acquire skills through cooperation, partnerships or licenses. SMEs that have this wealth of external and internal

knowledge generate value in performance in the internal and international market. Therefore, as underlined by Golovko and Cassiman (2011), a company's ability in research and development and its innovative capacity are factors of great success in favoring the decision to enter international markets. For these reasons, the higher the research and development of a company, as Cerrato (2006) points out, the greater the orientation of SMEs to enter the foreign market and start internationalization. From the literature, as also highlighted by Valentini and Golovko (2011), there is a reciprocal influence between innovation and internationalization of SMEs. Still, according to the scholars and confirmed by Filippetti and Archibugi's studies (2010, 2011), SMEs are experimenting with new ways of doing business and an innovative culture that also arises from exchanges with other companies. This is the birth of a virtuous circle that favours great growth opportunities, especially when it comes to environmental innovation or eco-innovation. Chiva et al. (2014) studied its benefits and positive effects on performance.

Recent studies have clearly highlighted the dynamics of interactive relationship among the eco-innovation and internationalization: the benefits of eco-innovation are not limited to improving environmental performance, but also allow companies to obtain numerous monetary and economic advantages: the inclusion of eco-innovation in company products and processes, in addition to reducing environmental degradation, promotes satisfaction of current customer needs, and at the same time helps companies gain competitive advantages and increase their market segments. In this way, companies improve and expanded their reputation on the global market, providing a flexible, responsive and responsible organizational image (Juniati et al., 2019). Therefore, eco-innovation strategies are crucial for economic performance, achieve cost savings, respond to market demand, enter new markets, effectively fight fierce competition, build or enhance business reputation, achieving sustainability goals (Hojnik et al., 2018).

Governments' efforts should be directed not only at changing the current eco-regulations, and eco-policies, but also at respective transforming the institutional environment, promoting green education, and shaping citizens as well as businesses commitment to sustainable and, therefore, competitive objectives (Malgorzata et al., 2022).

2.1 Conceptual Framework and Development Hypothesis

Since Fussler and James (1996) first invented the concept, eco-innovation has started to attract the attention of many scholars, and different definitions have been re-proposed over time. The most widely used and accepted definition is that developed by Kemp and Pearson (2007): "Eco-innovation is the production, assimilation or exploitation of a product, production process, service or management or business method that is novel to the organisation (developing or adopting it) and which results, throughout its life cycle, in a reduction of environmental risk, pollution and other negative impacts of resources use (including energy use) compared to relevant alternatives".

As Horbach, et al. (2012) point out, eco-innovations can also result from other economic rationalities such as increasing market share or reducing costs. The literature concerning the taxonomy of eco-innovation is wide and extensive. Many classifications differ according to the characteristics considered, the purpose of the

innovation, the dimension analyzed (for example, social, economic, institutional, etc.) and other aspects. By wanting to give a single classification, it is possible to consider the definition developed by the OECD (2007), which seems to be the most used by experts and scholars in the environmental sector. There are four macro-categories of eco-innovations: 1) Environmental and technological innovations, 2) Organizational innovations for the environment, 3) Product and service innovations offering environmental benefits, and 4) Environmental System innovations (Kemp and Pearson, 2007). Regarding the first category, particular reference is made to environmental process innovations, better known under "eco-innovation process". The eco-innovation process introduces new technologies and methodologies that reduce energy consumption, a more efficient use of resources and, ultimately, a lower production costs for the firms. There are essentially two types of environmental process innovations: end of pipeline technologies and cleaner production technologies (Demirel and Kesidou, 2011). The first type of eco-innovation consists of technological solutions integrated into the final phase of production processes to transform emissions. The second type of eco-innovations concerns organizational innovations for the environment, or the introduction of organizational methods and management systems designed to address environmental issues related to products and processes. These require new infrastructure and systems that go far beyond the adoption of unique technology as prevention programs and environmental management and control systems such as ISO 14001 certifications and can be extended across the entire value chain. In particular, "value chain" management involves the engagement of many actors and cooperation with other SMEs. In the third category of eco-innovations there are new products or products that are significantly improved from an environmental perspective and respectful environment services. In the literature, several studies have focused on the factors that push companies to introduce environmental innovations. The reason lies in the fact that eco-innovations represent one of the main tools through which sustainable development can be achieved. In addition, demand factors include consumers' preference for green products and the need for companies to maintain an environmentally friendly image (Rennings, 1998). However, tracing the determinants of "normal" innovations to those of environmental innovations is not enough because eco-innovations have a particularity that makes them unique. Indeed, according to what the neoclassical school affirms, environmental innovations are characterized by a double externality both in the Research and Development phase "knowledge externalities" and in the innovation diffusion phase "environmental externalities". The first appears to be common to all types of innovation because when a company undertakes R&D activities, it generates positive knowledge spillovers that go beyond its boundaries. On the other hand, the second is linked to the environmental characteristic of the innovation, which, once introduced, produces positive effects on the environment. As far as SMEs are concerned, eco-innovations aim to contribute to a company's goals, such as cost reduction and revenue growth. The lowest common denominator highlighted is that eco-innovations positively affect environmental impacts and are characterized by efficient use of resource. As investigated by the De Marchi (2012), eco-innovations have a double positive effect due to the innovation itself and the positive impact on the environment.

Also, important and studied in the literature are the eco-innovation drivers categorized in demand pull and technology push, affecting SMEs. Unlike normal innovations, eco-innovations, as argued by Rennings (2000), are subject to a double externality and are encouraged by push and pull effects. For these reasons, the scholar states that the policies of governments and the skills in the field of innovation of SMEs that allow the creation of new products and processes are relevant. Moreover, from these peculiarities emerge according to the literature of the opportunities for SMEs, such as greater competitiveness, improved reputation, reduced costs, greater productivity. This also entails an increase in the operations that SMEs can initiate on the foreign market. Hence, this paper proposes the following hypothesis:

- H1: Eco-innovation has a positive impact on SMEs internationalization

The literature on eco-innovation has often highlighted how in recent years government policies have assumed a fundamental and stimulating role as investigated by Porter and van der Linde (1995). Also, according to their studies, environmental policies have the power to “force” or give guidelines to SMEs that want to deal with eco-innovation by stimulating its adoption through favourable economic incentives.

These policies stimulate competitiveness by creating significant growth opportunities. The role of green policies favouring SMEs innovation performance is studied more and more in the literature. The purpose of governments is to support the market and encourage investment in research and innovation, as underlined by the recent creation of the European Innovation Council. It is an instrument in favour of SMEs which has joined the European Research Council. European policies in this regard provide for direct aid, incentives concerning the protection and enhancement of research results and the protection and exploitation of green patents. Therefore, the regulations must be in line with the policies present in the international arena, with the international demand. Furthermore, according to research carried out by Desmarchelier et al. (2013), in a French case study on a company that offers services, a strong sensitivity to green policies, such as eco-taxes or financial incentives that have an impact, was highlighted positive on green investments. Many works in the literature by Horbach (2016) has highlighted the consequences and positive impact of subsidies on activities in eco-innovation by SMEs. The regulations stimulate companies to play an active role in eco-innovation to obtain benefits in terms of performance in the domestic and international market. Of course, not all companies are compliant and adapt minimally by not seeing these entail benefits. The literature has found which those policies give favourable incentives for SMEs to adopt eco-innovation. However, it is necessary to mention how these policies are not always easy to implement as pointed out with a practical case by Eidat (2008). In fact, some scholars have highlighted that the economic and financial incentives and therefore the policy tool are much more fragile on a practical level than what is highlighted in the literature. According to some scholars, the complementarity between innovative and green policies is effective. Therefore, the following hypothesis arises:

- H2: Eco-innovation policies have a positive impact on SMEs internationalization

Sharing knowledge is one of the most studied and investigated issues in the literature, especially in innovation and as regards the performance of companies on the foreign

market. According to Bercicchi (2008), to face today's environmental challenges, SMEs must deal with the outside world. This depends, as highlighted in the literature, on the network and on the relationships established with external actors. According to the literature, it is defined as an activity characterized by inter-organizational collaboration based on exchanging know-how or exchange of technology, often governed by an agreement. Cooperation in technology arises from the collaboration between one or more SMEs that share through an agreement part of their activity in research and development. This cooperation is based on a fundamental theory of reference, namely that of the theory of transaction costs, but not only assumes economic advantages but above all represents a medium-long term strategic relationship. There are many actors involved, such as universities, research centres, customers who create an ecosystem of green innovation. This is because green innovations are extremely complex at a systemic and process level, as underlined by De Marchi (2012).

The SMEs, through technological agreements, can share knowledge, increase their know-how in the field of research and development, thus leading to the acquisition of transversal skills that facilitate access to the international market. These agreements based on non-disclosure clauses allow a significant decrease in costs and risks and increase confidence in facing an increasingly difficult market such as the foreign one compared to the domestic one. This leads to a significant increase in efficiency and company organization. This is also the case for eco-innovation, which benefits from the instrument of cooperation in the technological field. Thanks to the cooperation, eco-innovations are improved through increasingly integrated skills that favour diversification between products, reducing their risks. The following hypotheses arise:

- H3: The cooperation on technology directly moderates the relations between eco-innovation and internationalization which is hypothesized in H1
- H4: The cooperation on technology directly moderates the relations between eco-innovation policies and internationalization which is hypothesized in H2

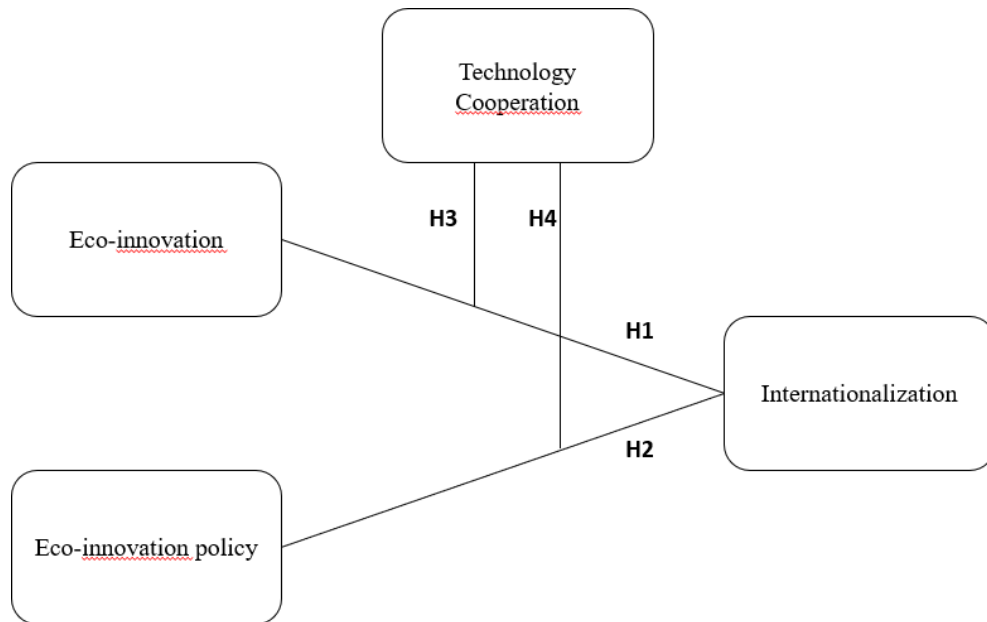


Figure 1: theoretical framework

2.2 Methodology

The literature analysis was carried out on EBSCO and Google Scholar, and in particular by inserting on the string the word eco-innovation in reference to the internationalization of SMEs. The analysis was conducted over a period of time ranging from 2011 to 2019. The unit of analysis considered are the SMEs of the ten European countries active in the field of eco-innovation: France, Germany, Sweden, Italy, Netherlands, Finland, Denmark, United Kingdom, Spain, Austria. To answer the research question and validate the hypotheses, a quantitative analysis was conducted through an OLS model. The paper data collection was carried out on Eurostat, the national statistical offices and the DIW Econ database on innovation and internationalization of SMEs and the Annual Report on European SMEs 2018/2019 (2019). In this paper, one of the independent variables used is the level of eco-innovation. According to the literature, many studies have measured this variable with R&D expenditure and green patents. In this study both measures were analyzed as highlighted by Demirel and Kesidou (2011). The dependent variable is represented by SMEs internationalization and according to the literature is very complex as a dimension and is multifactorial due to its complexity. For this, according to Cerrato and Piva (2012), it is defined as the relationship between foreign sales to total sales. In this context, foreign sales are defined as sales generated outside Europe and not in the European Union, given that in the analysis it is the UK was also involved. In this paper, one of the independent variables used is the level of eco-innovation. To validate the second hypothesis and measure the impact of the second independent variable, i.e. the policies in the field of eco-innovation on internationalization, are measured. In this paper, technological collaboration between SMEs is considered a moderating variable.

Multiple linear regression has been used to study the effects of the independent variables, the degree of eco-innovation on SMEs internationalization, and the moderating effect of cooperation on technology.

3. Model with the moderation effect of cooperation on technology

Model 1: OLS, with observations 2-90 (n = 89)
 Dependent variable: v8

Robust standard errors with respect to heteroskedasticity, variant HC1

	Coefficient	Standard deviation	t ratio	p-value
Constant variable	92833,1	6969,07	13,32	<0,0001 ***
V1 ISO certification	0,105098	0,138658	0,7580	0,4506
V2 R&D expenditure	16638,4	3189,74	5,216	<0,0001 **
V3 Green patents	1,13849	5,52951	0,2059	0,8374
V4 Eco-innovation policies	0,0189967	0,00752725	2,524	0,0135 **
V5 Scientific co-publications	-19,3285	3,76788	-5,130	<0,0001 ***
V6 Cooperation on technology	39,3656	353,119	0,1115	0,9115

The table shows R², sum of squares, Log-likelihood and β -value.

Mean dependent variable	40669,75	SQM dependent var.	29737,21
Sum of squares	3,51e+10	E.S. of the regression	20691,45
R-squared	0,548859	R-squared	0,515849
F(6, 82)	40,00941	P-value(F)	2,23e-22
Log-likelihood	-1007,076	Akaike Criterion	2028,151

Schwarz Criterion	2045,572	Hannan-Quinn	2035,173
-------------------	----------	--------------	----------

Inflation Factors of Variance (VIF) Minimum possible value = 1.0
 Values above 10.0 indicate a collinearity problem

v1	1,255
v2	2,018
v3	1,925
v4	1,191
v5	1,843
v6	1,969

Table 1: Model with the moderation effect of cooperation on technology.

4. Findings and Discussion

The OLS model with dependent variable Y, the SMEs internationalization, and the moderation effect of cooperation on technology, is quite robust, and the p-values are also good. The variables used in the model are significative and $R^2_{adj} = 0,515849$. As shown in the model at a unit increase of the variable V1 (ISO certification), the variables Y (SMEs internationalization) increase of 0,105098 keeping still the other variables. Considering the variable V2 (R&D expenditure), keeping still the other variables, at unit increase of V2(R&D expenditure) there is the same trend of Y of 16638,4. The same trend for V3 (green patents) and V4 (Eco-innovation policies) where at a unit increase of the variables V3 and V4, the dependent variable increases respectively of 1,13849 and 0,0189967. The hypothesis 1 and 2 of the study according to the results of the model have confirmed the importance of the level of eco-innovation and the strategic role of eco-innovation policies on SMEs internationalization. If we consider the variables V5 (scientific co-publications) we find an inverse trend, in fact our dependent variable Y decrease of -19,3285. The results also confirm the fundamental importance of the moderating role of cooperation between SMEs in the field of technology

In addition, according to the variance inflation factor, the variables do not have multicollinearity problems.

5. Conclusions

The paper results confirm Porter's hypotheses according to which strict policies in the field of eco-innovation and development of eco-innovation contribute to improving the internationalization of SMEs. Although much literature agrees, many scholars have analyzed the contrasting effects, especially in policies that are not always easy to implement. The study also confirms the fundamental role

of collaboration in the field of technology. These collaborations bring great benefits and involve SMEs and the whole world, which revolves around the enhancement of innovation and research results, favouring the entry of SMEs on the international market and creating favourable conditions for development, not only economic. However, the results are not yet particularly evident, and today the academy discusses the potential of eco-innovation on the internationalization processes of SMEs. According to scholars, eco-innovation can give greater competitiveness, improve reputation, and start a process of diversification of the products offered. Unlike the existing literature which highlighted the problems that SMEs had to solve when interfacing with a foreign market, this study highlights how eco-innovations can be fundamental and assume a strategic role for SMEs who want to enter a foreign market. The moderating effect presented in this research concerning technological cooperation in the context of the report between environmental innovation, environmental policies and internationalization is significant. This demonstrates how the SMEs that initiate technological cooperation processes are able to exploit the advantages of eco-innovation compared to those that do not cooperate.

In addition, public policies in the field of eco-innovation are of practical importance. We are witnessing more and more a growing concern about the environment. For these reasons, increasingly stringent environmental regulations must be disseminated. The policy should encourage the development of eco-innovation, and this study has shown, with many limitations, the positive effect. Once again, what is evident is the confirmation of Porter's hypotheses through the creation of a win-win situation both for the SMEs and the environment. According to some scholars, it is not a question of activating only financial incentives, but as Antonietti et al. (2015) highlighted in their studies, activating mechanisms to spread a shared culture that looks at the sustainable development of businesses and the territory.

6. References

Antonietti R., G. Corò, and F. Gambarotto (Eds.) (2015). *Uscire dalla crisi. Città, comunità, specializzazioni intelligenti*, FrancoAngeli.

Bercicchi L. (2008). *Innovating for sustainability. Green entrepreneurship in personal mobility*, Hoepli.

Casson M. and P.J. Buckley (1976). *The future of the multinational enterprise*, Palgrave Macmillan, London.

Casson M. and P.J. Buckley (2009). The internalization theory of the multinational enterprise: A review of the progress of a research agenda after 30 years, *Journal of international business studies* 40 (9), 1563-1580.

Cerrato D. and M. Piva (2012). The internationalization of small and medium-sized enterprises: the effect of family management, human capital and foreign ownership, *Journal of Management & Governance*, Springer, vol. 16(4), 617-644.

Cerrato D. (2006). “L’evoluzione del ruolo dell’ente locale nella gestione dei servizi pubblici”, in: R. Mele, A. Storlazzi (a cura di), *Aspetti strategici della gestione delle aziende e delle amministrazioni pubbliche*, Cedam, Padova, 157-1.

Chiva R., P. Ghauri and J. Alegre (2014). Organizational learning, innovation and internationalization: A complex system model, *British Journal of Management*, Wiley Online Library.

Dasgupta M. (2021). Sustainable innovation initiatives by small and medium enterprises: a systematic literature review, *Journal of Small Business & Entrepreneurship*.

De Marchi V. (2012). Environmental innovation and R&D cooperation: Empirical evidence from Spanish manufacturing firms. *Research Policy*, 41(3) 614–623. <https://doi.org/10.1016/j.respol.2011.10.002>.

Desmarchelier B., F. Djellal, and F. Gallouj (2013). Environmental policies and eco-innovations by service firms: An agent-based model. *Technological Forecasting and Social Change*, 80(7), 1395-1408.

Demirel P. and E. Kesidou (2011). Stimulating different types of eco-innovation in the UK: Government policies and firm motivations, *Ecological Economics*, Elsevier, 70(8), 1546–1557. <https://doi.org/10.1016/j.ecolecon.2011.03.019>.

Dunning, J. H. (2006). Towards a new paradigm of development: Implications for the determinants of international business activity. *Transnational Corporations*, 15 (1): 173–228.

Dunning, J. H. and A. Rugman (1985). The influence of Hymer's dissertation of the theory of foreign direct investment. *The American Economic Review*, 75 (2): 228–239.

EC-European Commission (2019). Annual Report on European SMEs 2018/2019—Research & Development and Innovation by SMEs. Publications Office of the European Union: Luxembourg.

Eiadat Y., A. Kelly, F. Roche and H. Eyadat (2008). Green and competitive? An empirical test of the mediating role of environmental innovation strategy.

EUROSTAT (2019). <https://ec.europa.eu/eurostat/web/structural-business-statistics/small-and-medium-sized-enterprises>.

Filippetti A. and D. Archibugi (2010). *Innovation in Times of Crisis: The Uneven Effects of the Economic Downturn across Europe*, MPRA.

Filippetti A. and D. Archibugi (2011), *Innovation in times of crisis: National Systems of Innovation, structure, and demand*, Research policy, Elsevier.

Frondel M., J. Horbach, and K. Rennings (2007). *End-of-pipe or cleaner production? An empirical comparison of environmental innovation decisions across*

Fussler C. and P. James (1996). *Driving Eco-innovation: A breakthrough discipline for innovation and sustainability. Business Strategy and the Environment*. Pitman Publishing. ISBN 0 273 622072.

Golovko E. and B. Cassiman (2011). *Innovation and internationalization trough export*, *Journal of international Business Studies* 42(1), 56-75.

Govindan K., H. Carvalho, S. G. Azevedo and V. Cruz-Machad (2017). *Modelling green and lean supply chains: An eco-efficiency perspective*, *Resources, Conservation and Recycling*, Volume 120, 75-87, ISSN 0921-3449.

Hitt M., H. Zhu and L. Tihanyl (2006). *The Internationalization of SMEs in Emerging Economies: Institutional Embeddedness and Absorptive Capacity*, *Journal of Small Business Strategy*, Vol.17. No.2 Fall/Winter 2006/2007.

Hojnik J., M. Ruzzier and T. S. Manolova (2018). *Internationalization and economic performance: The mediating role of eco-innovation*, *Journal of Cleaner Production*, 171, 1312-1323.

Horbach J. (2016). *Empirical determinants of eco-innovation in European countries using the community innovation survey*. *Environmental Innovation and Societal Transitions*, 19, 1–14. <https://doi.org/10.1016/j.eist.2015.09.005>.

Horbach J., C. Rammer and K. Rennings (2012). *Determinants of eco-innovations by type of environmental impact. The role of regulatory push/pull, technology push and market pull*, *Ecological economics*, Elsevier.

Hymer SH. (1968). *Multinational corporations*, Edward Elgar, London.

Johanson J and J. Vahlne (2017). From internationalization to evolution: The Uppsala model at 40 years, *Journal of international Business Studies* 48, 1087-1102.

Juniati S., M. Saudi, E. Astuty, and N. Mutalib (2019). The Impact of Internationalization in Influencing Firm Performance and Competitive Advantage: The Mediating Role of Eco-Innovation, *Int. J Sup. Chain.* Vol. 8, No. 1.

Kemp R. and P. Pearsons (2007). Final report MEI project about measuring eco-innovation. Deliverable 15 of the project MEI, FP6, Thematic Priority: call FP6-2005-SSP-5A.

Kemp R., (2010), *Eco-innovation: Definition, Measurement and Open Research Issues*, XXVII (3), 397-420, Repec.

Małgorzata S., T. Gołębiowski and M. Rószkiewicz (2022). Eco-innovation, International Competitiveness and Economic Performance of European Union Enterprises: Triangle Approach, *European Research Studies Journal*, Volume XXV, Issue 1, 635-645.

Masoni P. and A. Zamagni (2014). Sbloccare il potenziale di eco-innovazione delle PMI. Il ruolo delle società di servizi ad alto contenuto di conoscenza, *EAI-Energia, Ambiente, Innovazione* 5/2014.

OECD (2007). *Innovations and growth: Rational for innovation strategy*”, 3-29.

OECD (2020). *Financing SMEs and Entrepreneurs 2020: An OECD Scoreboard*, OECD Publishing, Paris.

Papadopoulos N. and O. Martin (2010). Toward a model of the relationship between internationalization and export performance, *International Business Review*, Vol. 19 No 4.

Porter, M. E. and C. van der Linde (1995). Toward a New Conception of the Environment-Competitiveness Relationship. *Journal of Economic Perspectives*, 9(4), 97-118. <https://doi.org/10.1257/jep.9.4.97>.

Rennings K., (1998), *Towards a Theory and Policy of Eco-Innovation - Neoclassical and (Co-) Evolutionary Perspectives*, ZEW Discussion Paper 98-24.

Rennings K. (2000). Redefining innovation, eco-innovation research and the contribution from ecological economics, *Ecological economics*, Elsevier.

Triguero A., L. Moreno-Mondéjar, and M.A. Davia (2013). Drivers of different types of eco-innovation in European SMEs. *Ecological Economics*, 92, 25-33. <https://doi.org/10.1016/j.ecolecon.2013.04.009>.

Valentini G. and E. Golovko (2011). Exploring the complementarity between innovation and export for SMEs' growth, *Journal of international business Studies*, Springer.

Wagner, M., and P. Lerena (2011). Eco-innovation through integration, regulation and cooperation: comparative insights from case studies in three manufacturing sectors. *Industry and Innovation*, 18(8), 747-764.

EQUITY MATTERS. FINANCING THE INTERNATIONAL ENVIRONMENT FUND (I.E.F.) THROUGH G7 SDRs QUOTAS

Gabriele Casano*

Abstract

The impacts of ungoverned globalisation and Global Climate Change (GCC) represent a crucial modern-day matter of concern. Thus, there is a need for international instruments offering concrete solutions, especially in the most vulnerable contexts, and the International Environment Fund (I.E.F.) meets these requirements. This paper defines an alternative funding channel for the I.E.F., intended as a "compensation fund and regulator of environmental balance between nations", which can guarantee its operativity in the long term and which - potentially - provides greater financial availability. Following the 2021 IMF's large-scale General Allocation, an almost unrepeatable opportunity has arisen for financing the I.E.F. through portions of SDRs quotas belonging to countries in debt in environmental terms, guaranteeing respect for the principle of equity and international justice.

Keywords: climate change, ecological footprint, SDRs, climate finance

1. Introduction

This article is part of the broader debate on alternative uses of the Special Drawing Rights (SDRs) following the International Monetary Fund (IMF) General Allocation of August 2021, more specifically in the context of financing responses tackling Global Climate Change (GCC). This research intends to highlight the fundamental aspects that a possible reallocation of SDRs resources from developed states to an International Environmental Fund (I.E.F.) could entail. The purpose is to inform political strategies capable of bringing this necessary and far-sighted long-term climate financing tool into the heart of the international agenda.

During the last months, several suggestions for the reallocation of SDRs have been contemplated, some of them come from international organizations and states leaders, others from researchers and think-thanks. To date, no concrete initiatives, aimed at a definite reallocation of most developed countries' SDRs resources to a specific climate-focused finance mechanism have been put on the table. Too much space has been left to the political will of the richest countries, but it is fundamental to channel

* Gabriele Casano. PhD Student in "Security, Risk and Vulnerability", curriculum "Risk, Climate Change and Sustainable Development", University of Genoa and CIMA Foundation, Genova, Piazzale E. Brignole, 3a. Email: gabriele.casano@edu.unige.it

these resources to most in-need countries with a long-term perspective reinforcing mitigation, adaptation, and ‘losses and damages’ (L&D) policies, but also local institutions and governments.

The vantage point of having been part of the research group “For a European Union - African Union Plan on the New Allocation of the IMF’s SDRs”¹ was decisive for acquiring professionals’ advice and sharing knowledge on SDRs related issues. The already promoted measures of the IMF concerning SDRs reallocation seem not sufficient to address the challenges of the GCC, especially in a context of high uncertainty due to the pandemic and considering the chronic climate finance ‘fatigues’.

Considering that the use of SDRs quotas depends on country-specific decisions and strategies, the IMF General Allocation of \$650bn in SDRs to the 190 countries belonging to the organization could be considered an exceptional opportunity not to be missed for shaping both the Earth's and next generations’ future. Nevertheless, political factors, countries' debt conditions, conflict and pandemic uncertainties may act as crucial obstacles. Disregarding the evidence coming from climate policy history, it seems reasonable to state that one of the main difficulties for the full implementation of the I.E.F. could be the political will of the main stakeholders involved: the IMF and member states' governments (especially the most influential ones), alongside MDBs and other relevant private actors. They could constitute an obstacle when the implementation of such a fund would call into question their strategic prerogatives, be they financial, economic or more generally political.

Alongside these considerations, it cannot be overlooked that technical problems are a major issue when considering the possibilities of an SDRs reallocation, especially if this activity requires changes in the statute of the IMF or an 85% majority in the IMF Executive Board. We expect that even considering the above-mentioned possible impediments, if there is a strong conviction on the part of even a small group of willing developed states the I.E.F. may take shape.

Starting from the reason why it is necessary to set up such a climate finance instrument according to expected and already well-known effects of GCC, it is subsequently necessary to establish the principles to adopt to define the funding shares of the I.E.F. The mechanism for reallocating SDRs must guarantee that resources from already developed states will flow to the most affected by GCC ones, thus the Fund could ensure compliance with the principles of equity and international justice.

Considering the complexity of GCC impacts, the inadequacy of actual climate funding, and the necessity of more coordinated and decisive actions to ensure sustainable development worldwide, this paper will provide a short overview of the current global environmental situation and needed strategies to implement according to the IPCC and other relevant scientific research. Analyses of IMF, SDRs and 2021 General Allocation associated issues help in finding partial solutions to climate finance lack.

¹ Research project coordinated by the Centro Studi sul Federalismo (CSF) with the Robert Triffin International Foundation (RTI) and the Centre Studies on European and Global Governance (CesUE), admitted to the funding by the Italian Ministry of Foreign Affairs and International Cooperation.

Thanks to these reflections, the characteristics and functions of a new mechanism to finance the I.E.F. could be defined.

This introductory section is followed by the corpus of the article, organised into three sections: the first one concentrates on the GCC, climate finance and international inaction; the second one explores IMF and SDRs related issues associated with the last General Allocation; the third one defines the characteristics and functions of a new mechanism to finance the I.E.F. The last section is devoted to conclusions and recommendations.

2. State of the (E)art(h)

The following investigations are rooted in the literature and scholarly debates in the field of climate change, international political economy, climate finance and development assistance. Starting from the proposal and analysis of Adamo (2017) this paper proposes a funding mechanism for the I.E.F. based upon the reallocation of SDRs quotas adapting what was suggested by Masini (2022) and Casano (2022) for the implementation of a “Next Generation Africa”. The data coming from IMF and other economic research teams will be flanked by data provided by the Ecological Footprint Explorer open data platform. The aim is to define principles for climate funding taking into account ecological aspects, in particular, the so-called Ecological Footprint.

2.1. The global environmental situation in the frame of the GCC

Recent IPCC reports issued between 2021 and 2022 warned that global warming is occurring much faster than in the past, moreover, it underlines that the consequences of this temperature rise are expected to be far worse than those predicted previously. Compared to the pre-industrial era, the global average temperature has already risen by 1.09°C. Among the countless warnings of the Report: since 2000, we observe 75% increase in the areas subject to fire risk; ice sheets are daily losing 8 billion tons of water thus contributing to the sea level rise; many countries have suffered intense heat waves even for prolonged periods; as well, we observe a general increase in the frequency of violent typhoons and hurricanes worldwide; on the other hand, severe droughts and desertification are spreading in some of the most vulnerable regions of the planet (IPCC, 2022). These are just some of the many worrying findings; the studies produced so far have, once again, underlined the close relationship between human activity and climate change. It is therefore considered necessary, among countless other actions, to reverse the trend in global CO₂ emissions and define trajectories for real sustainable development, but also to identify tools capable of ensuring adaptation, mitigation and recovery from losses and damages, particularly for those states that are most vulnerable.

In 2019, the richest 10% of the global population (771 million individuals) emits nearly 48% of global CO₂ emissions in a year, the top 1% emits 17% of the total, whereas the poorest half (3.8 billion individuals) of the global population emits 12% of global emissions (WIB, 2022). From the historical perspective, regional emissions inequality

is major: Europe and North America are responsible for around half of all CO₂ emissions since the Industrial Revolution; Chinese emissions represent only 11% of the historical total and Sub-Saharan Africa is just 4% (WIB, 2022). As presented in the World Economic Outlook 2017, most of the negative effects of GCC related disasters are felt in tropical countries where we find almost all low-income countries (IMF, 2017). This means that the most exposed countries have to implement the strongest adaptation policies and pay the most in terms of L&D (Eckstein, Künzel, & Schäfer, 2022).

Thus considered, the IMF called the international community to “play a key role in supporting these countries’ efforts to cope with climate change – a global threat to which they have contributed little” (IMF, 2017, p. 117). This statement reflects the principle of ‘common but differentiated responsibility and respective capabilities’ that have been at the core of the Kyoto Protocol, the Paris Agreement and the UNFCCC. Despite countless efforts to make this principle a driving force in the fight against the GCC and lead to concrete action, climate finance has never reached the desired levels, thus complicating the possibilities of responding adequately at the global level to GCC and greatly reducing the chances of creating resilient communities for those countries most vulnerable in both environmental and economic-financial terms.

2.2. Current climate finance situation

In order to understand the relevance of the creation of an I.E.F., it is necessary to understand the very nature of the current characteristics of so-called ‘climate finance’. According to the UNFCCC, this latter refers to:

“(…) local, national or transnational financing—drawn from public, private and alternative sources of financing—that seeks to support mitigation and adaptation actions that will address climate change”. (UNFCCC, 2022).

Even if the principle of ‘common but differentiated responsibility and respective capabilities’ has been established and remarked in the most significant international documents about how to cope with GCC, climate finance still largely relies on gifts and voluntary contributions. Furthermore, until now, a great part of climate finance has been focused on mitigation, but it is becoming increasingly evident that it is necessary to deal with adaptation and loss & damages (L&D) actions, too (Chowdhury & Jomo, 2022).

Furthermore, the main challenge is to define sustainable strategies of funding to help disadvantaged states in all these three fields of action. This task’s results are even more relevant while considering the ‘bittersweet’ reality of the financial system for the less developed countries which are very often the most affected by GCC too: loans for them are, on average, more expensive than for developed countries (Financial Times, 2018). Countries with greater sensitivity to climate impacts tend to have higher sovereign borrowing costs, for every sum paid in interest by developing countries, an additional 10% will be spent due to climate vulnerability, which means that their financial burden exacerbates and is expected to rapidly increase (Imperial College Business School and SOAS University of London, 2018). This undesirable effect has been depicted as the climate debt trap (Bassetti, 2019). According to the OECD, in 2019, the total climate

finance reached only US\$79.9bn and for 2020 results are not expected to be enhanced (OECD, 2021). These poor results are even worse considering that during COP15 in 2009, wealthy nations pledged to collectively mobilize US\$100bn annually for climate finance by 2020 to help vulnerable nations dealing with GCC. Action has not been up to speed with declarations of intent.

2.3. Need for international efficient instruments to tackle GCC

It has become universally accepted that substantial investments in adaptation are required to prevent the most unpleasant climate change outcomes; nevertheless, not enough attention has been devoted to the fact that boosting adaptation efforts can reduce negative impacts not only from social, ecological and economic points of view but also from the fiscal one. Investments that enhance resilience in climate-vulnerable countries are “crucial to not only helping vulnerable countries deal with the consequences of climate risks, but also bring down their cost of borrowing” (Imperial College Business School and SOAS University of London, 2018, p. iv). Reducing the probability of the occurrence of a ‘climate debt trap’ is in everyone's interest.

The ‘climate debt trap’ emphasises the need for international efforts to contribute to global attempts for resilience building and consequently prevent climate-related natural disasters leading to the debt trap. This undesirable condition highlights the need for international efforts to contribute to global efforts for resilience building and hence stop climate-related natural disasters leading to it. This is important for the whole Earth’s community for two main reasons: first, it will help with the development of low-income countries; secondly, it will also contribute to reaching the UN’s Agenda 2030 goals globally. The climate debt condition and the lack of sufficient resources for climate finance are not just moral issues of compensating climate change most affected societies, but also collective interests concerning international development and climate change impacts mitigation.

According to the findings of the Briefing Paper of the Global Climate Risk Index 2021, the international climate policy process needs to:

“a) (*provide*) a decision on how the need for support for vulnerable countries concerning future loss and damage is to be determined on an ongoing basis; b) (*define*) the necessary steps to generate and make available financial resources to meet these needs; and, c) strengthening the implementation of measures for adapting to climate change” (Eckstein, Künzel, & Schäfer, 2022, p. 5).

This research, describing how to implement and fund the I.E.F., will try to provide a framework and a concrete instrument capable of addressing the concerns expressed above. Furthermore, the I.E.F. principles would guarantee the respect of equity and international justice. Nonetheless, it remains a question of political will. As we will show later, the financial resources exist and the modalities of their management and allocation can be defined even in a relatively short-term timeframe.

3. The SDRs General Allocation and the National Ecological Footprint

3.1. The IMF and SDRs resources

To define how to use the resources provided by the IMF through a General Allocation of \$650bn in Special Drawing Rights (SDRs) to the 190 countries belonging to the organization is an interesting effort. Synthetically, we can say that SDRs are promissory notes issued by the IMF to member states on the basis of quotas associated with their relative strength in the world economy. According to Triffin, SDRs were conceived as a tool to make the rich even richer (Triffin, 1968). Members that receive these notes may either hold them or exchange a part of them over time for hard currency, through the IMF itself and central banks.

SDRs General Allocation aims to supplement existing official reserve assets of member countries and the decision of its implementation is based on the finding that there is a long-term global need to supplement existing reserve assets (in our case, the Covid-19 pandemic). Participating members and Prescribed Holders² can buy and sell SDRs in the voluntary market. To date, 15 organizations obtained the status of Prescribed Holders. SDRs may be used by IMF members and the IMF itself in accordance with the Articles of Agreement and decisions adopted by the Executive Board and Board of Governors (IMF, 2022). Specifically for smaller countries that may find it complex to gain access to foreign currency on the regular market, SDRs trading provides a crucial opportunity, especially in times of crisis.

As presented by several authors³, technical problems are a major issue when considering the possibilities of an SDRs reallocation from most developed States to the most in need ones considering the impacts of GCC, especially if this process requires changes in the statute of the IMF or an 85% majority in the IMF Executive Board. Despite these technical challenges, the main difficulty the funding and management of the I.E.F. may face is the political will of the main stakeholders involved: the IMF and its most powerful members, MDBs, national/regional Central Banks and other relevant financial, economic and political actors. As said before, States' availability - to invest part of their SDRs quotas for a climate-related action which would benefit most developed countries not immediately but over a longer period - should not be taken for granted. Political reasons, debt conditions and pandemic uncertainties may act as an impediment.

During the last months, several suggestions for the reallocation of SDRs have been contemplated, many of them coming from international organizations and leaders. Nevertheless, it is fundamental to remember that the use of SDRs quotas depends on country-specific decisions and strategies. An article signed by Kristalina Georgieva and Félix Tshisekedi⁴ underlines that:

² The IMF has the authority to prescribe other holders of SDRs, nonmembers, member countries that are not SDR Department Participants, institutions that perform the functions of a central bank for more than one member, and other official entities (IMF, 2022).

³ See, for example, (Andrews, 2021), (Plant, 2021) & (Viterbo, 2021). For an exploration of past proposals on alternative use of SDRs and related challenges see: (Aryeetey, 2004).

⁴ Kristalina Georgieva is Managing Director of the International Monetary Fund; Félix Tshisekedi is President of the Democratic Republic of the Congo and Chairman of the African Union.

“To tackle the climate crisis in Africa and put the continent on a new sustainable growth trajectory requires concerted efforts across national governments, the private sector, and the international community” (Georgieva and Tshisekedi, 2021).

What has been declared for Africa regarding tackling climate change and achieving sustainable development is valid for almost all regions of the world, with differences of course. Nevertheless, it remains imperative to recognise that global problems need global solutions.

In contemporary discussions, attention has often turned to the existing instruments put in place by the IMF; however, the measures – such as the reinforcement of the Poverty Reduction and Growth Trust and the institution of the Resilience and Sustainability Trust - seem not sufficient to address the challenges of GCC impacts and the difficulties of climate finance worldwide, especially in a context of high uncertainty due to the pandemic and the Ukrainian war.

An interesting UNDP Global Policy Network Brief underlines how it could be crucial to channel SDRs to target climate vulnerabilities:

“This would make sense not only because it would adhere to a global fairness principle, but also because debt and climate-vulnerabilities are highly correlated, climate change will intensify in the future, and because of the transmission channels from climate risk to financial and economic stability risk” (Jensen, 2021, p. 1).

Our analysis is in the same vein as that expressed above by the UNDP, resources of the last General Allocation are considered a great opportunity for funding the International Environmental Fund, ensuring compliance with the principle of ‘common but differentiated responsibility and respective capabilities’.

3.2. Linking the 2021 IMF General Allocation and the National Ecological Footprint

The \$650 billion General Allocation has disproportionately benefited developed countries (64.4% of the total SDRs allocation), the paradox is even more evident when considering that richer countries have a lower utilization rate of SDRs relative to developing ones and that they do not face the same financial constraints as developing countries (ECA-ECLAC, 2022). According to the data provided by Jensen, there is a high correlation between debt-vulnerable and climate-vulnerable countries; thus, nine of the top ten most climate-vulnerable countries in the world are highly debt-vulnerable developing economies, and more than 75% of countries that “score high on the IMF’s climate vulnerability index are highly debt-vulnerable” (Jensen, 2021, p. 6).

The ECA-ECLAC Report suggests that “the rate of SDR utilization can be used as a benchmark for determining the value of SDRs that developed countries can channel to developing countries” (ECA-ECLAC, 2022, p. 2). This could be a sufficient parameter to consider if we want to overcome discrepancies in terms of levels of development and take into account SDRs utilization rates. Although, in our vision, it is only one of the elements to consider while defining an alternative use of SDRs resources ‘in line with the time’. As proposed by the 2021 UNDP Global Policy Network Brief, the

IMF's climate vulnerability index could be considered while providing financial support for climate mitigation and adaptation. Furthermore, according to us, it is necessary to not neglect the unequal distribution of emissions worldwide and considering a quite comprehensive index like the Ecological Footprint⁵, as it has been developed by the Global Footprint Network, could be meaningful.

For our purposes, the Ecological Footprint is considered at the country level and it is measured in 'planet equivalents'⁶. As widely explained in the book "Ecological Footprint. Managing Our Biocapacity Budget", the Ecological Footprint is a metric that permits us to compare overall human demand on nature with what our planet can renew (its biocapacity). The Ecological Footprint directly reflects the use of natural resources and it is a measure of the impact of human society on the exploitation of those natural resources. When a population's ecological footprint exceeds the biocapacity of its territory, it runs a biocapacity deficit. This means that to balance the deficit it is necessary either receive biocapacity from elsewhere or to enhance the so-called 'ecological overshoot' that refers to national resources overuse. To date, humankind has already exceeded with its activities the regenerative capacity of the Earth during the 1970s (Wackernagel and Beyers, 2019).

We believe the Ecological Footprint is a trusted sustainability metric because of its increasing use in the academic, public and private environment. Furthermore, the processes of control and assessment of the related methodology ensure the quality and relevance of this metric at the international level. Thus considered, this paper proposes a reallocation method that considered the Ecological Footprint of states in order to reduce the existing gap between countries both in terms of SDRs allocation and countries' impacts on the environment. As explained by several authors⁷, the Ecological Footprint could be used as an indicator of environmental impact. We propose to redefine the allocation of SDRs following the Ecological Footprint indicator because it could be a suitable way to find resources for the implementation of the I.E.F and other mechanisms of support for less developed and vulnerable countries.

To redefine SDRs' resource allocation for each country, we simply divided the current resources received from the IMF through the 2021 General Allocation by the national

⁵ The consumption Footprint includes the area needed to produce the materials consumed and the area needed to absorb the carbon dioxide emissions. The Ecological Footprint is usually measured in global hectares (a global hectare is a biologically productive hectare with world average biological productivity for a given year). The consumption Footprint of a nation is calculated in the National Footprint and Biocapacity Accounts as a nation's primary production Footprint plus the Footprint of imports minus the Footprint of exports, and is thus, strictly speaking, a Footprint of apparent consumption. The national average of per capita Consumption Footprint is equal to a country's Consumption Footprint divided by its population. In other words, it measures how much area of biologically productive land and water a national population and activities are required to produce all the resources they consume and to absorb the waste they generate (Wackernagel and Beyers, 2019).

⁶ Every country's Ecological Footprint has a corresponding planet equivalent, or the number of Earths it would take to support humanity's Footprint if everyone lived like those residents of a given country. It is the ratio of an country's per capita Footprint to the per capita biological capacity available on Earth (1.6 gha in 2019). In 2019, the world average Ecological Footprint of 2.7 gha equals 1.75 planet equivalents.

⁷ For an analysis of the literature on the topic, see for example: (Matustik and Kocí, 2020).

Ecological Footprint expressed in terms of ‘planet equivalents’ used. By doing so, it was possible to reallocate resources to those countries that impact less on the environment (i.e. those that are not in environmental deficit), and to reduce SDRs allocated accordingly and proportionally for those that impact more. Ideally, each country should be able to consume at most the equivalent of one planet, which is why we have estimated a reallocation of SDRs from the deficit countries to the surplus countries. In the event this compensatory measure be opted for, it would still be necessary to take into account the progress made by those countries that are implementing virtuous policies despite a lower level of wellbeing.

The idea is to reward those states whose Ecological Footprint is less than a unit and, consequently, to reduce allocated SDRs for countries in environmental deficit proportionally to the number of ‘planet equivalents’ to their Ecological Footprint. Considering that most countries have already been in an environmental deficit and many of the most developed ones (e.g. Qatar, Australia, the United States...) consume much more than the average IMF member country (2 planet equivalents on average), it is normal that a significant amount of unallocated resources would result. Operating this redefinition of quotas, as if each country had a national footprint of 1 ‘planet equivalent’, it could be possible to obtain a ‘treasury’ of over 250 billion SDR.

Without neglecting that it would be almost impossible to benefit from the whole amount of the ‘treasury’, it seems at least conceivable to compensate virtuous countries (those with an Ecological Footprint inferior to 1 ‘planet equivalent’) because it means a reallocation of approximately 13,6 billion SDR only. This operation could be made voluntarily by the most developed and ecologically in-debt countries, nevertheless, this would be a preliminary and not sufficient action to reduce the SDRs gap between countries without changing the IMF treaties and looking at (even if only partially) the Ecological Footprint of member countries. The proposal presented here below wants to go further and explain how to mobilise SDRs resources for the implementation of the I.E.F.

4. Defining a new instrument to finance the I.E.F through G7 SDRs quotas

Recent analyses concerning how to use SDRs from the 2021 General Allocation have proposed several different paths: funding directly the Poverty Reduction and Growth Trust (PRGT) and the Resilience and Sustainability Trust (RST) of the International Monetary Fund (IMF, 2022); or finally the Liquidity and Sustainability Facility (LSF) launched by the Economic Commission for Africa (ECA, 2022); alternatively, deploying SDR resources to enhance the lending capacity of development banks and bolster regional and inter-regional financing institutions.

One of the first concrete proposal to create a ‘Green Fund’ with an initial capital injection including SDRs was presented in an IMF Staff Position Note providing a wide explanation of opportunities and challenges that this type of projects may entail (Bredenkamp and Pattillo, 2010). Recently, an interesting and relevant proposal comes from the 2021 UNDP Global Policy Network Brief that suggests: on the one hand, that part of the rechannelled SDRs quotas would be used to offer differentiated debt-relief

support to countries (issues of solvency or liquidity); on the other, that portions of SDRs quotas would be used for financial support for dealing with climate vulnerabilities according to a climate vulnerability assessment (Jensen, 2021).

Our proposal follows the second path proposed by Jensen and partially support the IMF Staff Position Note. We think that a hypothetical availability of 250 billion SDR (the above-mentioned ‘treasury’ calculated considering global neutrality in terms of Ecological Footprint) has many alternative uses but, considering the GCC contingencies, the primary opportunity is not to be employed through the mechanisms and modalities already defined by the IMF. Therefore, defining new parameters and less coercive conditionalities compared with IFM is the key to ensuring sustainable and long-term perspectives both for recipients and ecosystems worldwide. Furthermore, the I.E.F. could be an instrument not only available to states, but also to other actors involved in mitigation, adaptation and resilience-generating activities (public and private, for-profit and not-for-profit).

If there were political will, even only 20% of these resources (around 50 billion SDR) could be sufficient to finance the I.E.F in order to easily reach the 100 billion \$ annual requirement that the GCC fight is supposed to globally require. The remaining share of the ‘treasury’ would remain in the member countries’ hands according to national quotas within the IMF. This first proposal of a general reallocation of 20% SDRs quotas does not consider three main points that are crucial for the aims and purposes of the I.E.F. while deciding who and in which measure has to contribute:

- (1) If we want to ensure the respect of principles of equity and international justice, it is necessary to consider national development trajectories and exploitation of resources over time;
- (2) developed countries have much more resources and means to cope with the impacts of GCC in comparison with less-developed and more vulnerable countries, but also are very often those contributing the most to the ecological footprint at the planet level;
- (3) a general request cannot be made to voluntarily reduce all countries' own SDR availability, but a few pilot states need to be chosen amongst those that can carry out this reallocation with less difficulty in financial, economic and political terms.

In our vision, the more the Ecological Footprint is elevated the more countries have to contribute to funding the I.E.F. After multiple analyses of who should contribute based on factors such as available SDR resources, Ecological Footprint, development trajectories over time, economic-financial situation and international political weight, it was concluded that targeting the G7 countries might be the best way to start the I.E.F. financing journey. Thus, if the G7 members provide the I.E.F. with 25% of their SDRs quotas we will raise more than 49,5 billion SDRs and, even if they don't have the 7 most relevant Ecological Footprint by far, they represent those countries that have the most benefited in the time from world biocapacity. Moreover, these countries share 43,5% of the SDRs quotas and it is a substantial demonstration of the overall unequal distribution of resources. Furthermore, relying on G7 countries ensures that the I.E.F.

could receive a strong credit rating granting to issue debt at low funding costs to overcome the ‘debt trap’ afflicting less developed and more vulnerable countries⁸.

G7 - Member Countries	IMF SDR ALLOCATION (In billions of SDR)	ECOLOGICAL FOOTPRINT (N° Earths)	REVISED SDR ALLOCATION (SDR Allocation / N° Earths)	SDR SURPLUS (SDR Allocation - Revised SDR Allocation)	I.E.F. ALLOCATION (25% SDR Allocation)
Canada	10.565,90	5,1	2.071,75	8.494,15	2.641,48
France	19.317,80	2,79	6.923,94	12.393,86	4.829,45
Germany	25.527,90	2,95	8.653,53	16.874,37	6.381,98
Italy	14.443,90	2,72	5.310,26	9.133,64	3.610,98
Japan	29.540,10	2,91	10.151,24	19.388,86	7.385,03
United Kingdom	19.317,80	2,64	7.317,35	12.000,45	4.829,45
United States	79.546,20	5,13	15.506,08	64.040,12	19.886,55
Tot.	198.259,60		55.934,14	142.325,46	49.564,90

Table 1: G7 Member Countries. SDR General Allocation 2021, Ecological Footprint and I.E.F. Allocation.

These resources in SDR could be leveraged in capital markets to increase I.E.F. funding capacity through the mobilisation of private capital, too. Following in some ways, similar to what has been proposed by Masini for the “Next Generation Africa” (Masini, 2022) and according to the suggestion coming from the IMF Staff (Bredenkamp & Pattillo, 2010), the most plausible configuration to provide the I.E.F. with at least 250 billion \$ is the combination of a partial SDR allocation from the G7 members (49,5 billion SDR) and private investment leveraged from the market, with an implicit leverage ratio between four and five. This initial capital provision would be the basis to ensure, at least, 100 billion \$ annually available for the I.E.F. purposes, this 49,5 billion SDR has to be considered non-returnable, thus granting “a reserve account, and possibly also a subsidy account to further reduce interest costs for the poorest and most climate vulnerable borrowers” (Jensen, 2021, p. 8).

The I.E.F. resources might be allocated through both loans and grants, according to the type of action implemented. For adaptation and mitigation actions it would be preferable to accord loans, whereas for L&D operations grants are the most appropriate. Further discussions on this point are needed, especially considering the strategies that the I.E.F. would implement according to specific needs and climate change impacts uncertain nature. A key attribute of the I.E.F. has to be a sustainable mechanism “mobilizing resources quickly, providing a bridge to longer-term sources of funds” (Bredenkamp & Pattillo, 2010, p. 10).

⁸ For further analyses about challenges related to setting up a new climate fund funded through SDRs see: (Jensen, 2021).

Despite the undeniable opportunity that funding the I.E.F. thanks to a reallocation of SDRs quotas represents, there remain difficulties and obstacles in its implementation that should not be underestimated. First and foremost, the question of obtaining the status of Prescribed Holder from the IMF for the I.E.F., suddenly the maintenance of the reserve-assets character of the SDRs resources committed to the Fund. Many of the technicalities related to SDRs and their employment had been analysed by Aryeetey (2004), Actionaid (2010), Bredenkamp and Pattillo (2010), Flor (2019), Andrews (2021), Plant (2021) and Viterbo (2021), to cite a few. As it has been clearly explained by Andrews, the first step to ensuring the feasibility of an I.E.F. funded through SDRs is to determine its “purpose, terms, country coverage, conditionality framework, and other risk mitigation processes for new lending supported by contributions of SDRs” (Andrews, 2021, p. 5).

As said before, for the I.E.F. the most crucial action to undertake would be to obtain the status of Prescribed Holders from the IMF. According to the IMF Articles of Agreement (Art. XVII, section 3), “the Fund may prescribe as holders, non-members, members that are non-participants, institutions that perform functions of a central bank for more than one member, and other official entities”, in order to obtain this status an 85% majority of the total voting power is required. As a prescribed holder, the I.E.F. can acquire and receive SDRs, but it is not entitled to receive direct allocations from the IMF. Even in the event that Prescribed Holder status is granted to the I.E.F., it is necessary to obtain a positive opinion from the Executive Board of the IMF regarding both the transactions that would involve rechannelling part of the states' shares in SDRs to the I.E.F. and the financing transactions that the latter would undertake. It should be borne in mind that, notwithstanding the IMF's willingness to explore other options for voluntarily rechanneling SDRs, the I.E.F. would envisage a substantial change in the way SDRs would be used, and therefore a positive opinion by 70% of the Executive Board is required.

5. Conclusions and Recommendations

This article contributes to the debate on how to cope with GCC impacts, considering environmental depletion and development inequalities. Thus, we sustain the statement of Persaud:

“we need to reach a settlement that treats climate change as if equity matters. And that requires a new financial instrument that gets us the scale we need while tying together the changing geography of current emissions, the historic contributions to the stock of greenhouse gasses, and the need for climate adaptation for frontline states” (Persaud, 2021).

In our vision, one of the most interesting solutions to overcome the chronic ‘climate finance fatigue’ (exacerbated by the Covid-19 pandemic), guaranteeing that less developed and more vulnerable to GCC states, but also more virtuous ones in terms of Ecological Footprint, could benefit from financial resources enabling them to reinforce mitigation, adaptation, and ‘losses and damages’ (L&D) actions according to an equity principle. Recognizing the value of global common responsibility and underlining the leading role in environmental justice of most developed countries, we urge in

particular the governments of the G7 member countries (but also all other countries, continental organizations, international institutions, MDBs, private actors and civil society) to consider using part of the SDR resources allocated by the IMF in August 2021 to finance the implementation of the I.E.F. that respects the principles and objectives first described by Adamo in 2017.

In the event of the I.E.F. implementation, it is of primary importance to establish rules that enable its sustainability over time through measures that guarantee adequate resources and effective monitoring of the use of funds. This can only take place if clear rules and precise objectives are established. These must primarily take into account environmental variables (e.g. vulnerability to the impacts of the GCC) and seek to reduce the negative effects due to disadvantaged economic and financial situations of most disfavoured countries. Concerning the modalities of resource redistribution, the Climate-driven INFORM Risk Index⁹ promoted by the IMF is considered relevant. Moreover, given the complexities involved in the use and monitoring of SDRs, it is desirable that the I.E.F. should be defined in agreement with the IMF. This latter should play a supporting role, particularly in the area of monitoring, without, however, envisaging the same conditionalities that characterise the IMF's instruments, towards which many criticisms have been raised for decades.

6. References

Actionaid (2010, February). Using Special Drawing Rights for Climate Finance. *A Discussion Paper*.

Adamo F. (2017). The International Environment Fund (IEF), for sustainable energy and social progress for all. *GeoProgress Journal*, 4(1).

Andrews D. (2021). Reallocating SDRs to Multilateral Development Banks or other Prescribed Holders of SDRs. *Center for Global Development*.

Aryeetey E. (2004). A Development-Focused Allocation of the Special Drawing Rights. In A. B. Atkinson, *New Sources of Development Finance*. Oxford University Press.

Bassetti F. (2019, October 29). *The cruel irony of climate debt. Foresight: the CMCC observatory on climate policies and futures*. Taken from <https://www.climateforesight.eu/migrations-inequalities/the-cruel-irony-of-climate-debt/>.

⁹ It is an adaptation of the INFORM Risk Index, adjusted by IMF staff to distill and centralize on climate-driven risks. It has three dimensions: climate-driven hazard & exposure, vulnerability, and lack of coping capacity (IMF, 2022).

Bredenkamp H., Pattillo C. (2010, March 25). Financing the Response to Climate Change. *IMF Staff Position Note*.

Casano G. (2022). Next Generation Africa: which opportunities and challenges in the definition of a new instrument reallocating european SDRs to the African continent. *Perspectives on Federalism*, 14(1), 44-63.

Chancel L. (s.d.). Climate change & the global inequality of carbon emissions, 1990-2020. *World Inequality Lab*.

Chowdhury A., Jomo S. K. (2022). The Climate Finance Conundrum. *Development*, 65, 29–41.

ECA (2022, June). *Launch of the Liquidity and Sustainability Facility*. Taken from <https://www.uneca.org/events/launch-of-the-liquidity-and-sustainability-facility>.

ECA-ECLAC (2022, April). Special Drawing Rights (SDRs) and the COVID-19 crisis. *COVID-19 Report*.

Eckstein D., Künzel V., Schäfer L. (2022). *Global Climate Risk Index 2021. Who Suffers Most from Extreme Weather Events? Weather-Related Loss Events in 2019 and 2000-2019*. Germanwatch.

Financial Times (2018, July 03). *Climate challenge vulnerable countries take higher debt payment hit*. Taken from <https://www.proquest.com/newspapers/climate-challenge-vulnerable-countries-take/docview/2081903684/se-2?accountid=15964>.

Flor E. (2019). *SDR: From Bretton Woods to a World Currency*. Peter Lang.

Georgieva, K., Tshisekedi, F. (2021, December 17). Africa Cannot Confront Climate Change Alone. *Project Syndicate*. Taken from <https://www.project-syndicate.org/commentary/supporting-climate-adaptation-in-africa-by-kristalina-georgieva-and-felix-tshisekedi-2021-12>.

IMF (2017, October). *World Economic Outlook 2017. Seeking Sustainable Growth: Short-Term Recovery, Long-Term Challenges*. Taken from <https://www.imf.org/en/Publications/WEO/Issues/2017/09/19/world-economic-outlook-october-2017#Chapter%203>.

IMF (2022, June). *Climate Change Dashboard - Financial and Risk Indicators*. Taken from <https://climatedata.imf.org/pages/fi-indicators>.

IMF (2022, May). *Factsheet - Special Drawing Rights (SDR)*. Taken from <https://www.imf.org/en/About/Factsheets/Sheets/2016/08/01/14/51/Special-Drawing-Right-SDR>.

IMF (2022, June). *Special Drawing Rights (SDRs)*. Taken from <https://www.imf.org/en/Topics/special-drawing-right>.

Imperial College Business School and SOAS University of London (2018). *Climate Change and the Cost of Capital in Developing Countries (Executive Report)*.

IPCC (2022). *Impacts, Adaptation and Vulnerability. Summary for Policymakers*. Taken from https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicSummary.pdf.

Jensen L. (2021, June). An Unprecedented Opportunity to Boost Finance for Development - The Upcoming Special Drawing Rights Allocation. *UNDP Global Policy Network Brief*.

Masini F. (2022). Time for a Next Generation Africa. *Perspectives on Federalism*, 14(1), 1-12.

Matustík J., Kocí V. (2020). What is a footprint? A conceptual analysis of environmental footprint, *Journal of Cleaner Production*.

OECD (2021, September). *Climate finance provided and mobilised by developed countries: Aggregate trends updated with 2019 data*. Taken from https://www.oecd-ilibrary.org/finance-and-investment/climate-finance-provided-and-mobilised-by-developed-countries-aggregate-trends-updated-with-2019-data_03590fb7-en.

Persaud A. (2021, November). *Saving Paris: An economically efficient and equitable rescue plan*. Taken from VoxEU (CEPR's policy portal): <https://voxeu.org/article/saving-paris-economically-efficient-and-equitable-rescue-plan>.

Plant M. (2021). The Challenge of Reallocating SDRs: A Primer. *Center for Global Development*.

Triffin R. (1968). *Our international monetary system; yesterday, today, and tomorrow*. New York: Random House.

UNFCCC (2022, May). *Introduction to Climate Finance*. Taken from <https://unfccc.int/topics/climate-finance/the-big-picture/introduction-to-climate-finance>.

Viterbo A. (2021, November). The 2021 IMF Allocation of Special Drawing Rights: Too Little, Too Late and Too Unequal. *Osservatorio sulle attività delle organizzazioni internazionali e sovranazionali, universali e regionali, sui temi di interesse della politica estera italiana*.

Wackernagel M., Beyers, B. (2019). *Ecological Footprint. Managing Our Biocapacity Budget*. Global Footprint Network.

WIB (2022, May). *World Inequality Bank*. Taken from <https://wid.world/>