

Lecture Notes in Networks and Systems 482

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# New Metropolitan Perspectives

Post COVID Dynamics: Green and Digital Transition, between Metropolitan and Return to Villages Perspectives

 Springer

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Francesco Calabrò · Lucia Della Spina ·  
María José Piñeira Mantiñán  
Editors

# New Metropolitan Perspectives

Post COVID Dynamics: Green and Digital  
Transition, between Metropolitan and Return  
to Villages Perspectives

 Springer

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# Preface

This volume contains the proceedings for the fifth International “NEW METROPOLITAN PERSPECTIVES. Post COVID Dynamics: Green and Digital Transition, between Metropolitan and Return to Villages’ Perspectives”, scheduled from May 25–27, 2022, in Reggio Calabria, Italy.

The symposium was promoted by LaborEst (Evaluation and Economic Appraisal Lab) of the PAU Department, Mediterranea University of Reggio Calabria, Italy, in partnership with a qualified international network of academic institution and scientific societies.

The fifth edition of “NEW METROPOLITAN PERSPECTIVES”, like the previous ones, aimed to deepen those factors which contribute to increase cities and territories attractiveness, both with theoretical studies and tangible applications.

This fifth edition coincides with what is most likely the end of the COVID pandemic that began in 2020. The global health emergency, despite having been a phenomenon limited in time, has acted as an accelerator of some changes in behavior and in the organization of activities associated with the ever-increasing spread of ICT.

The phenomena are too recent and still ongoing to fully understand the implications they will have on settlement systems, but the conclusion reached at the previous edition of New Metropolitan Perspectives seems to be confirmed: from many of the works presented at the Symposium, a reduction in the relevance of the localization factor emerges with ever greater clarity, at least in the ways known so far from the times of the Industrial Revolution, bringing to light more and more a paradigm shift in the center-periphery dualism.

In fact, the phenomenon that in the past led to the birth of the modern city, the need to concentrate people and activities in small areas, seems to be decreasing: the progressive spread of smart working and the digital modality for the provision of services (just think, e.g., of the digital services of the Public Administration or online commerce) significantly reduces the gaps in terms of accessibility to goods and services between metropolitan cities and marginalized areas, such as inland areas.

But this edition of the symposium also coincides with the start of a new phase for European policies, guided toward the green and digital transition, for the period 2021-27, by the European Green Deal, especially through the tool of the Next Generation EU.

The links between new technologies and sustainability tend to focus on the role played and that can play the city at EU level in fighting climate change.

Many of the contributions collected in this volume address the issue of the green transition through multidisciplinary points of view, dealing with very different issues such as, for example: infrastructures and mobility systems, green buildings and energy communities, ecosystem services and the consumption of soil, providing interesting information on the main trends in progress.

The changes in individual behavior and social organization, associated with the digital transition, are illustrated by the contributions that have addressed the issue of rules and of social innovation practices that are prefiguring new forms of governance for the regeneration of settlement systems. In this context, the issues of the new declinations of the concept of citizenship were also addressed, also with reference to the need to create favorable contexts for individual initiative and entrepreneurship, especially for young people, as a possible response to the challenge of employability for the new generations.

In this context, territorial information systems take on a leading role, together with apps capable of making territories increasingly smart.

The substantial investments planned by the EU to support the green and digital transition in the coming years require multidimensional evaluation systems, capable of supporting decision makers in selecting the interventions most capable of pursuing the objectives. The financial resources used for the implementation of the policies are borrowed from future generations, to whom we will have the obligation to be accountable for our work.

Unfortunately, at the time of writing we must also register serious concerns for the future of humanity, stemming from the risks of the spread of the conflict between Russia and Ukraine. In addition to the obvious concerns about the suffering that was always cause to civilian populations, this situation makes future scenarios even more uncertain: It is clear that the circulation of goods, people and ideas will be increasingly conditioned by future geopolitical balances.

The ethics of research, in the disciplinary sectors that the Symposium crosses, invites us to feed, with scientific rigor, policies and practices that make the territory more resilient and able to react effectively to catastrophic events such as the pandemic or the war: We hope to know the outcomes of these courses in the next editions of the New Metropolitan Perspectives symposium.

For this edition, meanwhile, the more than 300 articles received allowed us to develop 6 macro-topics, about “Post COVID Dynamics: Green and Digital Transition, between Metropolitan and Return to Villages’ Perspectives” as follows:

1. Inner and marginalized areas local development to re-balance territorial inequalities

2. Knowledge and innovation ecosystem for urban regeneration and resilience
3. Metropolitan cities and territorial dynamics. Rules, governance, economy, society
4. Green buildings, post-carbon city and ecosystem services
5. Infrastructures and spatial information systems
6. Cultural heritage: conservation, enhancement and management.

And a Special Section, Rhegion United Nations 2020-2030, chaired by our colleague Stefano Aragona.

We are pleased that the International Symposium NMP, thanks to its interdisciplinary character, stimulated growing interests and approvals from the scientific community, at the national and international levels.

We would like to take this opportunity to thank all who have contributed to the success of the fifth International Symposium “NEW METROPOLITAN PERSPECTIVES. Post COVID Dynamics: Green and Digital Transition, between Metropolitan and Return to Villages’ Perspectives”: authors, keynote speakers, session chairs, referees, the scientific committee and the scientific partners, participants, student volunteers and those ones that with different roles have contributed to the dissemination and the success of the Symposium; a special thank goes to the “Associazione ASTRI”, particularly to Giuseppina Cassalia and Angela Vigliani, together with Immacolata Lorè, for technical and organizational support activities: without them the Symposium couldn’t have place; and, obviously, we would like to thank the academic representatives of the University of Reggio Calabria too: the Rector Prof. Marcello Zimbone, the responsible of internationalization Prof. Francesco Morabito, the chief of PAU Department Prof. Tommaso Manfredi.

Thank you very much for your support.

Last but not least, we would like to thank Springer for the support in the conference proceedings publication.

Francesco Calabrò  
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# An Automatic Tool for the Definition of a Sustainable Construction Investment Index

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**Abstract.** With reference to a study sample related to eleven countries (Australia, Canada, Denmark, Germany, Iceland, Ireland, Italy, New Zealand, Norway, Sweden and United Kingdom), the present work intends to identify the impact of specific factors on the sustainability of the construction sector through the definition of a composite index. In particular, in order to investigate the different contributions of the factors chosen for the analysis, the data collected for the selected countries are processed by an automatic tool. The research could represent a valid reference for the Public Administrations to monitor the construction sector and to define strategies and policies able to improve the sustainability of territorial transformation interventions and built environment.

**Keywords:** Sustainability index · Construction sector · Automatic tool · COIN tool · Territorial interventions

## 1 Introduction

The Paris Agreement (2015) is the legally binding treaty focused on the climate change with the aim to reduce the temperature by 1.5° compared to the preindustrial levels [1]. During the recent years, each country involved in the agreement has produced an action plan based on a five-year cycle that has to be reviewed by the United Nation (UN) Committee [2]. The international agreement addresses the importance of reducing greenhouse gas emissions, in order to make the countries carbon neutral [3–6]. Besides, the UN have developed a specific Agenda for Sustainable Development, aimed “to achieve a better and more sustainable future for all”. Among the seventeen goals settled (Sustainable Development Goals – SDGs), the goal 12 should be highlighted, that states “by 2030, substantially reduce waste generation through prevention, reduction, recycling, and reuse” [7]. However, nowadays the built environment involves a large quantity of material and energy consumption [8, 9] and the construction sector is responsible for

39% of the total global emissions [10]. In this sense, the processes aimed at the urban regeneration represent a relevant “tool” for the built environment sustainability [11–13].

In order to monitor and assess the construction sector performances, in the present research an automatic tool to calculate a composite index has been implemented. In this sense, the study aims at defining a Sustainable Construction Index (SCI) able i) to synthesize the current conditions of each country or region and ii) to address countries government’s funding and policies to achieve net-zero carbon emissions. Indeed, a comparative analysis of data collected in eleven countries worldwide (Australia, Canada, Denmark, Germany, Iceland, Ireland, Italy, New Zealand, Norway, Sweden and United Kingdom) has been carried out, to understand the trends on the effects of the financial incentives, policies, and in general the built environment on the carbon dioxide emissions (CO<sub>2</sub>e). Therefore, an automatic tool capable of assessing and ranking the index for each country selected for the case study, has been developed through the use of specific indicators. In particular, the analysis has allowed to monitor the countries’ performance in CO<sub>2</sub>e within the construction sector and the relationships between policy models and funding for existing buildings and the reduction of CO<sub>2</sub>e. Through the trends of each performance criteria and the overall ranking of the countries, the outputs obtained have highlighted the most effective policies and funding reference models.

The manuscript is organized as follow: in Sect. 2 a brief recognition of the current literature referring the adoption of indices for the assessment of the sustainability in the construction sector is included; in Sect. 3 the description of the case study with specific regard to the tool adopted, the steps that leads to the application of the tool and the interpretation of the results obtained are carried out; finally in Sect. 4 the conclusions are presented.

## 2 Current State of Art Related to Composite Indices

The assessment of the sustainability of the construction sector is a complex task [14, 15]. Similarly, the measurement and the comparison of the effects of environmental funding’s and policies introduced by a country are difficult [16]. A recent study has highlighted that, in the current literature, the adoption of sustainability criteria and indicators is uneven and the methodology approaches and the tools are manifold [17]. Moreover, the equivocal definition of sustainable development complicates the process of selecting the indicators to be considered for the quantitative assessment of the sustainability.

In order to support and guide the governments in the adoption of effective policies to improve the sustainability of the construction sector, during the last decades, different researches have been developed [18–23]. In particular, Ayman and Wafaa have carried out a study to establish an International Sustainability Index [24]. Bon and Hutchinson [25] have structured a framework to deepen the comprehension of the economic aspects that involve the construction sector. Furthermore, with specific reference to the highway’s construction projects – that are the most energy-consuming projects [26] - a composite index has been calculated using an Analytical Hierarchy Process, that have been applied to the outputs of a survey to obtain the weights of each parameter included in the model [27]. Moreover, a composite sustainability index of a project has been defined by using a multi-criteria decision-making approach referring to the Lithuanian construction

industry: sustainability criteria have been chosen and grouped on the basis of the literature analysis and a survey has been used to select and rank the most important ones [28].

In addition, given the ability of composite indices to represent complex issues in a concisely and effectively way, these have been used in multiple application fields, such as: the assessment of the resilience of territories [29], the ability of territories to react to natural disasters e.g. floods [30], or the security of the environment related to the energy sector [31].

## 2.1 The COIN Tool

As mentioned above, in order to assess complex and multidimensional issues such as human development, environmental performance, sustainability of the construction sector etc. – which are often difficult to define and cannot be quantitatively and directly measured – composite indices are typically used. The adoption of indices could be considered as a standard approach for policies analysis because of their ability to synthesize the performance of specific issue related to a country or a region against multiple analytic criteria. To give scientific support to the governments to develop new strategical policies, in 2019 the Joint Research Centre (JRC) of the European Commission has developed an automatic tool – named COIN Tool – aimed to (i) graphically visualize the composite indicator; (ii) analyze the relationships between the different indicators considered; (iii) check the robustness of certain assumptions [32].

Firstly, there is the need to clearly define the aspect to be measured and assessed, and then the implementation of the tool could be carried out. In particular, the main four steps of the COIN tool are [33]:

1. Selection of the indicator to be used;
2. Collection and analysis of the data;
3. Data categorization;
  - a. Normalization;
  - b. Weighting;
4. Execution of the tool.

## 2.2 The Steps Leading to the Application

With reference to the case study of the research related to eleven countries (Australia (AU), Canada (CA), Denmark (DE), Germany (GE), Iceland (IC), Ireland (IR), Italy (IT), New Zealand (NZ), Norway (NO), Sweden (SW) and United Kingdom (UK)), in order to achieve the definition of the synthetic index for the assessment of the sustainability of the construction sector, 15 national indicators have been selected (*step 1*). Thus, for each country, the most appropriate sources have been identified and data have been collected (*step 2*). The data set could have multiple levels of aggregation, with sub-indices (*sn*), different pillars (*pn*) and sub-pillars (*spn*) to which each indicator is assigned. In Table 1 the name, the acronym, a brief description and the unit of measure of the indicators selected in the present research, and the sub-pillar to which they belong are reported.

In particular, it should be outlined that the SCI calculated in the analysis has only two levels of aggregation: in this sense, the sub-index corresponds to the index and in the tool hierarchical structure there is only one pillar and the indicators are categorized into four sub-pillars (*step 3*):

- Socio-economic aspects – referred to the factors involved both in the economic and social processes.
- Environmental aspects – all the factors related to environment with specific attention to items related to carbon emissions.
- Construction aspects – concerning the built environment and related quantitative issues.
- Funding aspects – regarding to the factors that imply the government power of each country.

**Table 1.** Description of the performance indicators selected

N. of indicator	Performance indicator	Description	Unit of measure	Sub-pillar
Ind. 01	Density	Density of population of each country	Pop/km <sup>2</sup>	Socio-economic sub-pillar 01
Ind. 02	Construction Market value	Market value referred to the construction sector of each country	USD*1,000,000	
Ind. 03	Inflation	The increase in the general average level of prices of goods and services referred to year 2019 for each country	%	
Ind. 04	Real gross domestic product (GDP) per capita	The GDP per citizen for the year 2019	USD	
Ind. 05	CO <sub>2</sub> e Growth	CO <sub>2</sub> emission recorded for each country between years 1990–2018	%	Environmental sub-pillar 02
Ind. 06	CO <sub>2</sub> e Construction Sector	CO <sub>2</sub> emission recorded for each country referred to the construction sector	Tons	

(continued)

**Table 1.** (continued)

N. of indicator	Performance indicator	Description	Unit of measure	Sub-pillar
Ind. 07	CO <sub>2</sub> e Construction waste	The percentage of CO <sub>2</sub> emission recorded for each country referred to the waste involved in the construction sector	Tons	
Ind. 08	Carbon Pricing	The cost applied to carbon emissions	USD per ton CO <sub>2</sub>	
Ind. 09	Total Dwellings	The number of existing dwellings for each country	n	
Ind. 10	New dwellings per year	The number of new dwellings for referred to the year 2019	n./year	
Ind. 11	Vacant dwellings	The number of vacant dwellings for each country	n	
Ind. 12	Protected buildings	The number of buildings that benefit from artistic and cultural protection measures	n	
Ind. 13	Average age of buildings	The average age of existing building at a national level	Year	
Ind. 14	Environmental funding	The presence of funding specifically referred to the protection of existing building	Point scale from 1 – very low funding to 5 – very high funding	Funding sub-pillar 04
Ind. 15	Environmental policy	The presence of specific national policies concerned the protection of existing building	Dummy indicator 1 – presence or 0 – absence of policies	



Once collected the data, the numerical values obtained have been normalized compared to their maximum value (*step 3a*). Moreover, an equal weighting for each indicator has been assigned (equal to score “1”) and an arithmetic aggregation method has been implemented (*step 3b*). Furthermore, a “direction” to each indicator has been assigned in order to give some indications on the relationship between each factor and the construction sustainability (score “-1” for negative aspects and score “+1” for the positive ones). In Table 2 the characteristics of each performance indicator are summarized.

**Table 2.** Characteristics of each performance indicator

N. of indicator	Indicator	Sub-pillar	Weighting	Aggregation	Direction
Ind. 01	Density	sp.01	1	Arithmetic	-1
Ind. 02	Construction Market value	sp.01	1	Arithmetic	-1
Ind. 03	Inflation	sp.01	1	Arithmetic	-1
Ind. 04	Real GDP per capita	sp.01	1	Arithmetic	1
Ind. 05	CO <sub>2</sub> e Growth	sp.02	1	Arithmetic	-1
Ind. 06	CO <sub>2</sub> e Construction Sector	sp.02	1	Arithmetic	-1
Ind. 07	CO <sub>2</sub> e Construction waste	sp.02	1	Arithmetic	-1
Ind. 08	Carbon Pricing	sp.03	1	Arithmetic	-1
Ind. 09	Total Dwellings	sp.03	1	Arithmetic	-1
Ind. 10	New dwellings per year	sp.03	1	Arithmetic	1
Ind. 11	Vacant dwellings	sp.03	1	Arithmetic	1
Ind. 12	Protected buildings	sp.03	1	Arithmetic	-1
Ind. 13	Average age of buildings	sp.04	1	Arithmetic	1
Ind. 14	Environmental funding for existing buildings	sp.04	1	Arithmetic	1
Ind. 15	Environmental policy for existing buildings	sp.04	1	Arithmetic	-1

### 2.3 Interpretation of the Results

The implementation of the COIN tool has allowed to obtain the SCI for each country selected in the present research. In Table 3 the values of the SCI, sub-pillars and indicators are reported. On the basis of the SCI calculated, the definition of a ranking has been

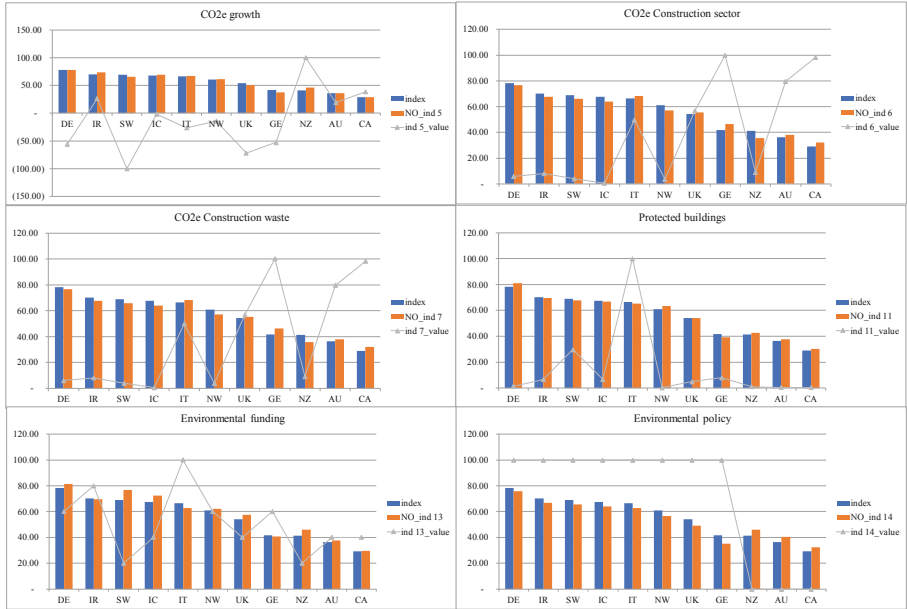
carried out: Denmark is the country for which the best performance in terms of sustainability has been resulted. The outputs related to the socio-economic sub-pillar point out Ireland at the top and Canada at the bottom of the based ranking. Furthermore, the results regarding to the environmental sub-pillar show Italy in the first place by considering the three different categories for CO<sub>2</sub>e and construction sector emissions. In general terms, for this sub-pillar for the European Union countries the best performance is detected compared to the other countries analyzed. The construction sub-pillar's results highlight that Denmark and Sweden present the top ranking: Denmark performs the best across all criteria with the oldest building stock and least new dwellings per year. With reference to the Sub-pillar 04, for Denmark the best performance results are assessed.

**Table 3.** Outputs of the implementation of the COIN tool for the case study.

Item	DE	IR	SW	IC	IT	NW	UK	GE	NZ	AU	CA
<b>SCI</b>	<b>78.33</b>	<b>70.11</b>	<b>69.01</b>	<b>67.54</b>	<b>66.55</b>	<b>60.96</b>	<b>54.21</b>	<b>41.71</b>	<b>41.30</b>	<b>36.27</b>	<b>29.07</b>
p.01	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
sp.01	78.65	66.70	67.74	67.84	71.48	57.20	60.51	49.12	35.52	32.80	21.20
sp.02	72.03	77.29	66.17	64.62	77.44	59.85	46.65	46.26	38.40	30.28	34.00
sp.03	81.89	72.50	67.66	68.18	61.81	69.07	55.66	39.19	38.93	38.29	29.10
sp.04	79.16	65.77	73.76	68.80	58.18	57.45	52.14	33.38	51.62	42.21	33.22
ind.01	79.68	69.58	67.74	65.83	68.50	59.12	57.07	43.02	38.49	32.92	25.35
ind.02	77.36	68.74	67.41	66.30	66.90	59.79	53.34	43.90	38.21	38.16	29.53
ind.03	77.21	70.72	69.31	71.10	64.88	62.49	56.20	43.78	40.95	35.41	25.34
ind.04	79.33	68.54	70.51	67.19	70.05	59.28	55.55	42.37	42.67	35.67	29.44
ind.05	78.35	73.81	65.57	69.39	66.92	61.40	50.69	37.86	45.88	35.82	28.89
ind.06	76.54	67.64	65.95	63.94	68.34	56.99	55.42	46.34	35.74	38.04	32.11
ind.07	76.54	67.64	65.95	63.94	68.34	56.99	55.42	46.34	35.74	38.04	32.11
ind.08	77.63	69.06	68.21	66.19	68.01	59.59	54.98	43.44	39.02	34.59	27.50
ind.09	77.89	69.42	68.40	66.19	65.31	63.50	54.82	41.85	39.45	36.88	29.08
ind.10	80.59	71.47	71.89	70.10	65.15	62.13	56.21	42.59	41.83	36.03	28.91
ind.11	81.06	69.58	67.72	66.84	65.15	63.50	53.96	39.28	42.63	37.75	30.27
ind.12	77.42	73.04	67.72	68.92	65.15	62.85	52.31	39.28	41.58	37.78	29.63
ind.13	81.47	69.57	76.68	72.27	62.83	62.18	57.46	40.78	45.88	37.52	29.52
ind.14	75.92	66.79	65.57	63.94	62.83	56.63	49.13	35.23	45.88	40.30	32.30
ind.15	77.67	76.15	76.68	70.95	69.85	67.74	50.30	39.32	45.88	29.19	26.45

In order to understand the further data, some individual indicators effects on the overall performance ranking of each country are reported in the graphs below (Fig. 1). The analysis has been carried out by not counting one of 15 indicators to check if some variations in the final ranking could be occurred. The changes that result on the

ranking of the countries if one of the 15 indicators (Nos. 5, 6, 7, 11, 13, and 14) is not considered is summarized in Fig. 1: the blue bar of the histogram represents the original value of SCI, the orange one corresponds to the value of the SCI calculated without the specific indicator and the grey line indicates for each country the value of the “excluded” indicator.



**Fig. 1.** Summary graphs representing the changes in the ranking by calculating the SCI without one specific indicator.

The outputs for the CO<sub>2</sub>e growth indicator (Ind. 05) show that for New Zealand and Ireland the results affect the overall performance rating, whereas for Denmark no modifications of the ranking are found, due to the high performance levels of all other indicators.

Referring to the CO<sub>2</sub>e Construction Sector indicator (Ind. 06), Germany has the highest emissions, so its performance rating position would increase if this indicator is excluded. For New Zealand a low value of CO<sub>2</sub>e is measured and, consequently, the overall ranking would decrease if this indicator is excluded. The overall rankings do not almost change, except for Italy country, for which the most relevant improvement could be observed that allows its transition from the fifth position to the second one.

The Construction Waste CO<sub>2</sub>e indicator (Ind. 07) moderately influences the ranking: the lower the CO<sub>2</sub>e number, the higher the countries performance. The data highlight that the EU countries performance is better than non-EU ones. It should be pointed out that the UK was still in the EU at the time of the data collection (2019). Denmark has minor CO<sub>2</sub>e from waste and, therefore, it holds the highest-ranking position. Without considering CO<sub>2</sub>e waste, Denmark’s performance would reduce while maintaining the

top position. Germany has a high amount of CO<sub>2</sub>e waste, and therefore if the waste was not included, the country performance would increase.

Aside from the protected building indicator (Ind. 11) the countries with a high number of protected building (Italy and Sweden) would decrease their performance: Denmark performs the best, whereas Canada holds the last position. The orange bar in the graphs shows the adjusted index, excluding the Protected Building indicator: Italy's overall performance would go down because it has such a high number of protected buildings, instead New Zealand's performance, with a low number of protected buildings, would go up. The overall order could change except for Germany and New Zealand. The outputs show that protected buildings are essential in a country's overall performance: the higher the number of protected buildings, the higher the performance.

Environmental funding indicator (Ind. 13) gives a point scale rating as all countries had some forms of funding. The levels drastically differ between EU and non-EU countries: the graph shows that Italy, with the highest amount of funding, would have a lower overall performance, while maintaining the position; instead, New Zealand, with the lowest amount of funding available, would have a higher performance if the funding is not considered. The graph in Fig. 1 points out the importance of financing in the SCI: for example Iceland, that is a country that uses primarily renewable energy, does not need financial incentives, and therefore the increase in position is not accurately representing the situation.

The graph on the presence of environmental policy indicator (Ind. 14) demonstrates that whether each country has a strategic specific policy, it would affect the overall performance value, while maintaining the original ranking. The existing policies in the EU countries and the United Kingdom show that programs positively influence the overall performance of the countries. Finally, the lack of policies in New Zealand, Australia and Canada strongly affects the countries performance.

### 3 Conclusions

The outputs obtained in the present research have outlined the relevance of developing tools able to assess and monitor the sustainability of construction sector.

In particular, the results of the implementation of the COIN tool have shown that the EU countries holds the highest ranking positions, whereas New Zealand, Canada, and Australia the lowest ones.

For socio-economic, Ireland has the best performance, followed by Denmark and Sweden. For environmental criteria, Denmark, Sweden, and Iceland have the highest performance ranking. The countries have the best performance in the carbon emissions across the construction sector, including the least amount of growth between 1990 and 2018 and the lowest emissions. Italy has the highest performance for the construction sector, followed by Sweden, Denmark, Iceland, and Ireland. The results show that the least new buildings, the oldest age of the building stock and the total number of protected buildings would increase the countries SCI performance.

Lastly, for the funding criteria, the performance ranking of each country reflects the current reference contexts: Italy has the highest performance thanks to the fiscal incentives introduction, i.e. the so-called *Superbonus* 110% aimed at supporting the

energy retrofit interventions [34, 35], and New Zealand has the lowest one, with the most negligible funding and policy relating to insulation and heating questions. Again, it should be pointed out that the EU countries perform a higher standard compared to Canada, Australia and New Zealand, as the framework and policies behind the EU are more developed.

By analyzing the performance of each country in the different issues considered, it is possible to identify the Denmark, Ireland, Sweden, and Iceland policies and funding models as a valid reference to reduce emissions. In this sense, the present research could represent a useful tool for the Public Administrations to monitor the construction sector and to define strategies and policies able to improve the sustainability of territorial transformation interventions and the built environment.

## References

1. United Nations. The Paris Agreement, <https://unfccc.int/>. Accessed 12 Nov 2021
2. Huang, L., Krigsvoll, G., Johansen, F., Liu, Y., Zhang, X.: Carbon emission of global construction sector. *Renew. Sustain. Energy Rev.* **81**, 1906–1916 (2018)
3. Spampinato, G., Malerba, A., Calabrò, F., Bernardo, C., Musarella, C.: Cork oak forest spatial valuation toward post carbon city by CO<sub>2</sub> sequestration. In: Bevilacqua, C., Calabrò, F., Della Spina, L. (eds.) *New Metropolitan Perspectives. NMP 2020. Smart Innovation, Systems and Technologies*, vol. 178, pp. 1321–1331. Springer, Cham (2021). [https://doi.org/10.1007/978-3-030-48279-4\\_123](https://doi.org/10.1007/978-3-030-48279-4_123)
4. Barrile, V., Malerba, A., Fotia, A., Calabrò, F., Bernardo, C., Musarella, C.: Quarries renaturation by planting Cork oaks and survey with UAV. In: Bevilacqua, C., Calabrò, F., Della Spina, L. (eds.) *New Metropolitan Perspectives. NMP 2020. Smart Innovation, Systems and Technologies*, vol. 178, pp. 1310–1320. Springer, Cham (2021). [https://doi.org/10.1007/978-3-030-48279-4\\_122](https://doi.org/10.1007/978-3-030-48279-4_122)
5. Massimo, D.E., Del Giudice, V., De Paola, P., Forte, F., Musolino, M., Malerba, A.: Geographically weighted regression for the post carbon city and real estate market analysis: a case study. In: Calabrò, F., Della Spina, L., Bevilacqua, C. (eds.) *ISHT 2018. SIST*, vol. 100, pp. 142–149. Springer, Cham (2019). [https://doi.org/10.1007/978-3-319-92099-3\\_17](https://doi.org/10.1007/978-3-319-92099-3_17)
6. Del Giudice, V., Massimo, D.E., De Paola, P., Forte, F., Musolino, M., Malerba, A.: Post carbon city and real estate market: testing the dataset of Reggio Calabria market using spline smoothing semiparametric method. In: Calabrò, F., Della Spina, L., Bevilacqua, C. (eds.) *New Metropolitan Perspectives. ISHT 2018. Smart Innovation, Systems and Technologies*, vol 100, pp. 206–214. Springer, Cham (2019). [https://doi.org/10.1007/978-3-319-92099-3\\_25](https://doi.org/10.1007/978-3-319-92099-3_25)
7. United Nations: Sustainable Development Goals. <https://www.un.org/sustainabledevelopment/development-agenda>. Accessed 12 Nov 2021
8. United Nation Environment Program: 2020 Global Status Report for Buildings and Construction: Towards a Zero-emission, Efficient and Resilient Building and Construction Sector. <https://globalabc.org/>. Accessed 12 Nov 2021
9. Del Giudice, V., Massimo, D.E., Salvo, F., De Paola, P., De Ruggiero, M., Musolino, M.: Market price premium for green buildings: a review of empirical evidence. case study. In: Bevilacqua, C., Calabrò, F., Della Spina, L. (eds.) *New Metropolitan Perspectives. NMP 2020. Smart Innovation, Systems and Technologies*, vol 178, pp. 1237–1247. Springer, Cham, Switzerland (2021). [https://doi.org/10.1007/978-3-030-48279-4\\_115](https://doi.org/10.1007/978-3-030-48279-4_115)
10. World Green Building Council. <https://www.worldgbc.org/news-media/WorldGBC-embodied-carbon-report-published>. Accessed 12 Nov 2021

11. Della Spina, L.: The integrated evaluation as a driving tool for cultural-heritage enhancement strategies. In: Bisello, A., Vettorato, D., Laconte, P., Costa, S. (eds.) SSPCR 2017. GET, pp. 589–600. Springer, Cham (2018). [https://doi.org/10.1007/978-3-319-75774-2\\_40](https://doi.org/10.1007/978-3-319-75774-2_40)
12. Della Spina, L.: Multidimensional assessment for “culture-led” and “community-driven” urban regeneration as driver for trigger economic vitality in urban historic centers. *Sustainability* **11**, 7237 (2019)
13. Della Spina, L.: Cultural heritage: a hybrid framework for ranking adaptive reuse strategies. *Buildings* **11**, 132 (2021)
14. Bell, S., Morse, S.: *Sustainability Indicators: Measuring the Immeasurable?* 2nd edn. Routledge (2012)
15. Warhurst, A.: *Sustainability Indicators and Sustainability Performance Management*. Mining, Minerals and Sustainable Development [MMSD] project report, 43, 129, International Institute for Environment and Development (IIED), United Kingdom (2002)
16. Botta, E., Koźluk, T.: Measuring environmental policy stringency in OECD countries: a composite index approach, OECD economics department working papers, No. 1177, OECD Publishing, Paris (2014)
17. Morano, P., Tajani, F., Guarini, M.R., Sica, F.: A systematic review of the existing literature for the evaluation of sustainable urban projects. *Sustainability* **13**, 4782 (2021)
18. Goel, A., Ganesh, L.S., Kaur, A.: Sustainability assessment of construction practices in India using inductive content analysis of research literature. *Int. J. Constr. Manag.* **21**(8), 802–817 (2021)
19. Stanitsas, M., Kirytopoulos K.: Investigating the significance of sustainability indicators for promoting sustainable construction project management. *Int. J. Constr. Manag.* (2021)
20. Calabrò, F., Cassalia, G., Lorè, I.: The economic feasibility for valorization of cultural heritage. The restoration project of the reformed fathers’ convent in Francavilla Angitola: the Zibib territorial wine cellar. In: Bevilacqua, C., Calabrò, F., Della Spina, L. (eds.) *New Metropolitan Perspectives*. NMP 2020. Smart Innovation, Systems and Technologies, vol 178, pp. 1105–1115. Springer, Cham (2021). [https://doi.org/10.1007/978-3-030-48279-4\\_103](https://doi.org/10.1007/978-3-030-48279-4_103)
21. Ayman, R., Alwan, Z., McIntyre, L.: BIM for sustainable project delivery: review paper and future development areas. *Arch. Sci. Rev.* **63**(1), 15–33 (2020)
22. Suchith Reddy, A., Rathish Kumar, P., Anand Raj, P.: Preference based multi-criteria framework for developing a Sustainable Material Performance Index (SMPI). *Int. J. Sustain. Eng.* **12**(6), 390–403 (2019)
23. Kabirifar, K., Mojtahedi, M., Wang, C., Tam, V.W.Y.: Construction and demolition waste management contributing factors coupled with reduce, reuse, and recycle strategies for effective waste management: a review. *J. Clean. Prod.* **263**, 121265 (2020)
24. Ayman, O., Wafaa, N.: Towards establishing an international sustainability index for the construction industry: a literature review. In: *First International Conference on Sustainability and the Future*, Cairo, Egypt, vol. 1 (2010)
25. Bon, R., Hutchinson, K.: Sustainable construction: some economic challenges. *Build. Res. Inf.* **28**(5–6), 310–314 (2000)
26. Gambaotese, J.A.: Sustainable roadway construction: energy consumption and material waste generation of roadways. In: *Construction Research Congress 183*, ASCE, Reston, VA, pp 1–13. American Association of State Highway and Transportation Officials (AASHTO) (2008)
27. Ibrahim, A.H., Shaker, M.A.: Sustainability index for highway construction projects. *Alex. Eng. J.* **58**(4), 1399–1411 (2019)
28. Dobrovolskienė, N., Tamošiūnienė, R.: An index to measure sustainability of a business project in the construction industry: lithuanian case. *Sustainability* **8**, 14 (2016)
29. Stanickova, M., Melecký, L.: Understanding of resilience in the context of regional development using composite index approach: the case of European Union NUTS-2 regions. *Reg. Stud. Reg. Sci.* **5**(1), 231–254 (2018)

30. Kotzee, I., Reyers, B.: Piloting a social-ecological index for measuring flood resilience: a composite index approach. *Ecol. Ind.* **60**, 45–53 (2016)
31. Shah, S.A.A., Zhou, P., Walasai, G.D., Mohsin, M.: Energy security and environmental sustainability index of South Asian countries: a composite index approach. *Ecol. Ind.* **106**, 105507 (2019)
32. European Commission. Coin tool. [https://knowledge4policy.ec.europa.eu/composite-indicators/coin-tool\\_en](https://knowledge4policy.ec.europa.eu/composite-indicators/coin-tool_en). Accessed 21 Nov 2021
33. Becker, W., Benavente, D., Dominguez Torreiro, M., Tacao Moura, C., Fragoso Neves, A., Saisana, M. Vertesy, D.: COIN Tool User Guide, EUR 29899 EN, Publications Office of the European Union, Luxembourg (2019)
34. Italian Revenue Agency. [https://www.agenziaentrate.gov.it/portale/documents/20143/233439/Guida\\_Superbonus\\_110%25+%281%29.pdf/c11d4bd6-af26-89f9-c557-efef7c6c7452](https://www.agenziaentrate.gov.it/portale/documents/20143/233439/Guida_Superbonus_110%25+%281%29.pdf/c11d4bd6-af26-89f9-c557-efef7c6c7452). Accessed 27 Nov 2021
35. Manganelli, B., Morano, P., Tajani, F., Salvo, F.: Affordability assessment of energy-efficient building construction in Italy. *Sustainability* **11**(1), 249 (2019)

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