ISSN: 2594-0937

REVISTA ELECTRÓNICA MENSUAL

Debates sobre Innovación

SEPTIEMBRE
2024

VOLUMEN 8
NÚMERO 2

Memorias LALICS 2023
Academia de Maestría -Seminario LALICS
Paraguay, PY.

UNIVERSIDAD AUTÓNOMA METROPOLITANA
Casa abierta al tiempo
Unidad Xochimilco

MEGI
MAESTRÍA EN ECONOMÍA, GESTIÓN Y POLÍTICAS DE INNOVACIÓN

LALICS
LATIN AMERICAN NETWORK FOR ECONOMICS OF LEARNING, INNOVATION AND COMPETENCE BUILDING SYSTEMS

DEBATES SOBRE INNOVACIÓN. Volumen 8, Número 1, junio-agosto 2024. Es una publicación trimestral de la Universidad Autónoma Metropolitana a través de la Unidad Xochimilco, División de Ciencias Sociales y Humanidades, Departamento de Producción Económica. Calzada del Hueso 1100, Col. Villa Quietud, Del. Coyoacán, C.P. 04960, Ciudad de México. Teléfonos 54837200, ext.7279. Página electrónica de la revista http://economiaeinnovacionuamx.org/secciones/debates-sobre-innovacion y dirección electrónica: megct@correo.xoc.uam.mx Editor Responsable: Dra. Gabriela Dutrénit Bielous, Coordinadora de la Maestría en Economía, Gestión y Políticas de Innovación.

Gabriela Dutrénit Bielous, Departamento de Producción Económica, División de Ciencias Sociales y Humanidades, Unidad Xochimilco. Calzada del Hueso 1100, Col. Villa Quietud, Del. Coyoacán, C.P. 04960, Ciudad de México. Fecha de última modificación: diciembre de 2019. Tamaño del archivo: 36.5 MB

SUSTAINABILITY AND GOAL FITNESS INDEX FOR THE ANALYSIS OF SUSTAINABLE DEVELOPMENT GOALS: A METHODOLOGICAL PROPOSAL

Sanny González.

Universidad Nacional de Asunción, Facultad Politécnica

Gabriel Pereira.

Universidad Americana, Facultad de Ciencias Económicas y Administrativas, Lab-iDi

Arturo González.

Universidad Americana, Facultad de Ciencias Económicas y Administrativas, Lab-iDi. arturo.gonzalez@americana.edu.py

Abstract

The Sustainable Development Goals (SDGs) were adopted in September 2015 by the 193 member states of the United Nations (UN), which include 17 goals, 169 targets and 244 indicators, as an attempt to radically change the approach of the Sustainable Development Goals. Millennium Development (MDG). Since theadoption of the 2030 Agenda, the scientific community has increased its interest in the evaluation, analysis, and evaluation of the interrelationships between the SDGs, proposing different approaches and using a diversity of methodological tools for the interactions of the SDGs. This research proposes a methodology that takes advantage of the concepts of Economic Fitness for the creation of a Sustainability Fitness Index (SFI) for the countries and a Goal Fitness Index (GFI) for each SDG. These indices are intended to provide a tool to analyze the interrelationships between the Sustainable Development Goals in such a way that they offer a new approach to address the capacities of the countries and the fulfillment of the SDGs. The results of the SFI are a first attempt to identify development priorities aligned with the SDGs in each country, based on their available productive capacities, which could help make more efficient use of their limited resources and increase the achievement of the SDGs.

Keywords: *Sustainable Development Goals (SDGs), Economic Fitness, Complexity, Sustainability Fitness Index (SFI), Goal Fitness Index (GFI), Goal Achievement Capability (GAC), Sustainability.*

Resumen

Los Objetivos de Desarrollo Sostenible (ODS) fueron adoptados en septiembre de 2015 por los 193 estados miembros de la Organización de las Naciones Unidas (ONU), que incluyen 17 objetivos, 169 metas y 244 indicadores, como un intento de cambiar radicalmente el enfoque de los Objetivos de Desarrollo Sostenible. Desarrollo del Milenio (ODM). Desde la adopción de la Agenda 2030, la comunidad científica ha incrementado su interés en la evaluación, análisis y evaluación de las interrelaciones entre los ODS, proponiendo diferentes enfoques y utilizando diversidad de herramientas metodológicas para las interacciones de los ODS. Esta investigación propone una metodología que aprovecha los conceptos de Aptitud

Económica para la creación de un Índice de Aptitud para la Sostenibilidad (SFI) para los países y un Índice de Aptitud para la Meta (GFI) para cada ODS. Estos índices pretenden brindar una herramienta para analizar las interrelaciones entre los Objetivos de Desarrollo Sostenible de tal manera que ofrezcan un nuevo enfoque para abordar las capacidades de los países y el cumplimiento de los ODS. Los resultados del SFI son un primer intento de identificar prioridades de desarrollo alineadas con los ODS en cada país, con base en sus capacidades productivas disponibles, que podrían ayudar a hacer un uso más eficiente de sus limitados recursos y aumentar el logro de los ODS.

Palabras clave: *Objetivos de Desarrollo Sostenible (ODS), Economic Fitness, Complejidad, Índice de Desempeño para la Sostenibilidad (SFI), Índice de Aptitud para los Objetivos (GFI), Capacidad de Logro de Metas (GAC), Sostenibilidad.*

I. Introduction

The 2030 Agenda represents a new era in the worldwide challenge of achieving some of the most ambitious objectives for the humanity, setting a "plan of action for people, planet and prosperity" that must be achieved within 15 years (2015-2030) (UN, 2015). In this pathway towards sustainability, the countries have experienced several implementation challenges, including limited resources (economic, human, infrastructure, etc.), highly complex network of interactions between SDGs, and lack of alignment between national development plans and the 2030 Agenda. (Lack of policy coherence; policy vs politics).

As many experts have underlined, in this global scenario and facing the complexity and universality of the SDGs, a priority setting for the implementation of the 2030 Agenda is recommended (Pereira et al, 2021; Allen et al., 2018; Allen et al., 2018a; Weitz et al., 2018; Zelinka & Amadei, 2019; McGowan et al., 2018), in order to: improve the qualitative and quantitative understanding on SDGs interactions; identify direct and indirect effects of SDGs interactions; detect patterns on SDGs interactions; identify critical goals and targets (central nodes) in the SDG network; and secondary analyses to increase synergies and avoid trade-off in the implementation of the 2030 Agenda.

This work follows the ideas presented in (Pereira et al., 2021) who presented a paper that studies the interactions between countries and their compliance with the SDGs from the point of view of complex systems, based mainly on the theory of economic complexity proposed by (Haussman et al., 2014).

The aim of this study is to propose a new methodological approach for the analysis of the SDG interlinkages and the progress of the countries in the implementation of the 2030 Agenda, based on their accumulated sustainability capabilities measured using economic fitness and network theory (Tacchella et al., 2012; Cristelli et al., 2013; Tacchella et al., 2013; Pugliese, Zaccaria & Pietronero., 2016).

II. Literature Review

Since 2016 the scientific community has increased its interest in the assessment, analysis, and evaluations of the interlinkages between the SDGs, proposing different approaches and using a diversity of methodological tools for SDG interactions. Moreover, the analysis of SDG interlinkages offers fundamental information for policymakers, guiding the decision- making and the policy-design, to balance the different interests of the country (social, economic, or environmental).

In this context, the authors have begun to focus the analysis in the progress of countries in the accomplishment of the SDGs, through rankings (by goals, targets or indicators), qualitative methodologies, traffic light approaches, and many others (Griggs et al., 2017; ICSU, ISSC, 2015; Sachs et al., 2018; Schmidt-Traub et al., 2017; Salvia et al., 2019), in order to identify critical goals and targets for the sustainable development of the countries.

Nowadays, the report made by (Sachs et al., 2018) and published annually since 2016 with Bertelsmann Stiftung and the Sustainable Development Solutions Network (SDSN), is the reference for evaluating the progress of countries towards sustainable development.

The analysis and evaluation of the SDGs is a very complex task, as it has been already underlined in several studies (Dargin et al., 2019; Karnib, 2017; McCollum, et al., 2018), therefore, new methodologies have been proposed in the last years to improve our understanding.

Recent studies have incorporated semi- quantitative methodologies with the purpose of improving the comprehension of the interactions (synergies and trade-off) in the intricate and complex SDG network, offering a new perspective in the analysis and visualization of the different interactions (i.e. network analysis) (Allen et al, 2018; Allen et al, 2018a; Weitz et al., 2018; Zelinka & Amadei, 2019; McGowan et al, 2018; Lusseau & Mancini, 2018).

The results of these studies are relevant for policymakers and stakeholders to comprehend the nature of the SDG interlinkages and to improve the SDG

priority setting at the national level. Nevertheless, even if we still have low understanding of the SDG interactions, the existent literature in this topic have demonstrated that there are more positive interactions (synergies) than trade-off in the SDG network (Weitz et al., 2018; Nerini et al., 2017; Maes et al., 2019).

The challenge of understanding the intricate and complex SDG network of interactions have been clearly explained by (Weitz et al., 2018), which have expressed: “Understanding interactions between targets requires quite detailed information, but it also requires the ability to maintain a holistic view of the system as a whole, since it is possible that one policy change can change the dynamics of the whole system”.

III. Methodology

This research proposes a methodology that takes advantage of the concepts of Economic Fitness for the creation of a Sustainability Fitness Index (SFI) of the countries and a Goal Fitness Index (GFI) for each SDGs. These indices are intended to provide a tool to analyze the interrelationships between the Sustainable Development Goals in such a way as to offer a new approach for addressing the capabilities of the countries and the fulfilment of the SDGs.

To achieve the implementation of the proposed methodology, two fundamental steps are required. The first step is to identify the SDG compliance capabilities of each of the study countries, like the use of the RCA index proposed by Balassa (1966); and in a second step, perform the calculations of the SFI and the GFI based on the mathematical models proposed by Tacchela et al., (2012).

IV. Results

Results related to SFI and GFI were obtained, in addition to the validations carried out for the model.

In terms of the SFI, results were obtained for 191 countries, where their sustainability capabilities can be inferred based on compliance with the SDGs. Figure 1 shows graphically the general results of the SFI.

The Figure 1 show the results SFI through heat map for the year 2019, where warmer colors reflect lower levels of sustainability fitness. Then, from Figure 1, the biggest challenges for the accomplishment of the SDGs mainly remain in Africa and Southeast Asia. In the same context, the biggest challenge in South America seems to be in Bolivia, Chile, Venezuela, and Ecuador. Nevertheless, from the results of the SFI we can observe a diversity and heterogeneity of performances worldwide, with countries showing a strong path towards sustainable development and the achievement of the SDGs

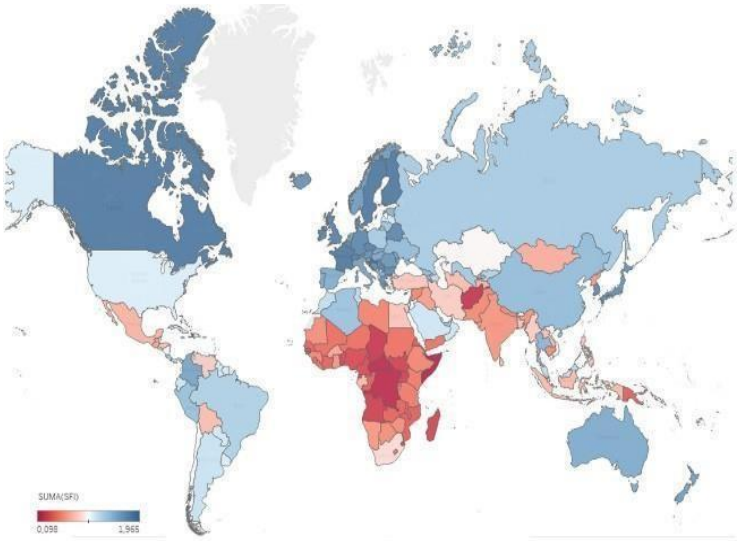

Figure 1: Worldwide SFI 2019.

The list of the top-10 performers in the SFI, shows mostly European and high-income countries. In the other hand, in the list of worst performers in the SFI, we mainly find African and low-income countries. However, further studies are needed to improve our understanding of the correlation and causality between performance on the SFI, level of income and the achievement of the SDGs worldwide.

In Table 1 you can see the result obtained for the GFI. The SDGs that are at the bottom of the ranking are those for which the least capabilities are required for their implementation in the countries. On the other hand, the SDGs with the highest GFI and therefore located in the first places, correspond to those that are highly complex, so not many countries have the capacity to achieve them.

Table 1: Ranking of GFI 2019.

Rank	***Goal***	***GFI 2019***
1	*Goal 16*	*2,073*
2	*Goal 2*	*1,962*
3	*Goal 3*	*1,689*
4	*Goal 9*	*1,434*
5	*Goal 10*	*1,295*
6	*Goal 6*	*1,136*
7	*Goal 1*	*0,984*
8	*Goal 5*	*0,851*
9	*Goal 8*	*0,806*
10	*Goal 7*	*0,802*
11	*Goal 14*	*0,779*
12	*Goal 4*	*0,760*
13	*Goal 11*	*0,674*
14	*Goal 17*	*0,466*
15	*Goal 15*	*0,443*
16	*Goal 13*	*0,435*
17	*Goal 12*	*0,411*

V. Conclusions

The methodological approach proposed in this study aims to guide the policy-design and decision-making in countries, through the use and consideration of data, capabilities, comparative advantages, and fitness metrics. As in previous studies, the analysis of the SFI is limited to the availability of data series, public information, and reliable data on the progress of the countries in their performances in the different SDGs.

The results of the SFI are a first attempt to identify development priorities aligned with the SDGs in each country, based on their available productive capabilities, which could help to make a more efficient use of their limited resources and boost the achievement of the SDGs. Following this path could help the country countries to accelerate their way towards sustainable development and to create synergies within the SDG network.

It is important to highlight that by taking the Economic Fitness model, applied to the analysis of the SDGs, it is possible to take advantage of the virtues to

obtain more information about the capabilities necessary to achieve a goal. This occurs because the countries that achieve few goals provide more information, since it can be inferred that the goals that these countries have achieve with less capabilities than others and have still managed to meet them.

For the next steps, we suggest further studies on the SFI and GFI, to improve the experimentation and validation of the mathematical model and fitting the parameters used to define which countries presents the minimal capabilities to achieve an SDG.

References

- 1 Abdon, A., Felipe, J., 2011. The Product Space: What Does It Say About the Opportunities for Growth and Structural Transformation of Sub-Saharan Africa?. Working Paper No. 670, Levy Economic Institute of Bard College.
- Alcamo, J., 2019. Water quality and its interlinkages with the Sustainable Development Goals.
- Current Opinion in Environmental Sustainability, 36, pp. 126–140.
- Allen, C., Metternich, G., Wiedmann, T., 2018. Prioritising SDG targets: assessing baselines, gaps and interlinkages. Sustainability Science. https://doi.org/10.1007/s11625-018-0596-8
- Allen, C., Metternich, G., Wiedmann, T., 2018a. Initial progress in implementing the Sustainable Development Goals (SDGs): a review of evidence from countries. Sustainability Science. https://doi.org/10.1007/s11625-018-0572-3
- Balassa, B., 1965. Trade liberalisation and "revealed" comparative advantage. Manch Sch, 33(2), pp.99–123. http://dx.doi.org/10.1111/j.1467-9957.1965.tb00050.x.
- Bleischwitz, R., Spataru, C., VanDeveer, S.D., Obersteiner, M., van der Voet, E., Johnson, C., Andrews-Speed, P., Boersma, T., Hoff, H., van Vuuren, D.P., 2018. Resource nexus perspectives towards the United Nations Sustainable Development Goals. Nature Sustainability, Volume 1, pp. 737-743. https://doi.org/10.1038/s41893-018-0173-2
- Dargin, J., Daher, B., Mohtar, R.H., 2019. Complexity versus simplicity in water energy food nexus (WEF) assessment tools. Science of the Total Environment, 650, pp. 1566–1575. https://doi.org/10.1016/j.scitotenv.2018.09.080
- Dörgo, G., Sebestyén, V., Abonyi, J., 2018. Evaluating the Interconnectedness of the Sustainable Development Goals Based on the Causality Analysis of Sustainability Indicators. Sustainability 2018, 10, 3766; doi:10.3390/su10103766
- El-Maghrabi, M. H., Gable, S., Osorio Rodarte, I., Verbeek, J., 2018. Sustainable Development Goals Diagnostics: An Application of Network Theory and Complexity Measures to Set Country Priorities. World Bank Group - Office of the Senior Vice President UN Relations and Partnerships. Policy Research Working Paper 8481, WPS8481.
- Felipe J, Hidalgo CA. Economic diversification: implications for Kazakhstan. Development and modern industrial policy in practice. Issues and country experiences. Cheltenham UK: Edward Elgar Pub; 2015.
- Gusmao, R.G., Leal Filho, W., Gonçalves, O.L., de Mattos, D.L., Veigas, L., 2018. A literature-based review on potentials and constraints in the implementation of the sustainable development goals. Journal of Cleaner Production, 198, pp. 1276-1288. https://doi.org/10.1016/j.jclepro.2018.07.102
- Hausmann R, Hidalgo CA, Bustos S, Coscia M, Chung S, Jimenez J., Simoes, A., Yildirim, M., 2011. The Atlas of economic complexity: mapping paths to prosperity. Cambridge, Mass: Center for International Development, Harvard University; Harvard Kennedy School; Macro Connections, Massachusetts Institute of Technology
- Hausmann, R., & Hidalgo, C. A. (2011). The network structure of economic output. Journal of Economic Growth, 16(4), 309–342. DOI:10.1007/s10887-011-9071-4

- Hausmann R, Klinger B. Growth diagnostic: Peru. Inter-American Development Bank; 2008a. Tech.
- Rep.
- Hausmann R, Klinger B. Achieving export-led growth in Colombia Tech Rep. 2008. p. 2008. Hausmann R, Hwang J, Rodrik D. What you export matters. J Econ Growth 2007;12(1):1–25.
- http://dx.doi.org/10.1007/s10887-006-9009-4.
- Hausmann, R., Morales, J.R., Santos, M.A., 2016. Economic Complexity in Panama: Assessing Opportunities for Productive Diversification. HKS Faculty Research Working Paper Series RWP16-046.
- Hausmann, R., Hidalgo, C.A., Stock, D.P., Yildirim, M.A., 2014. Implied Comparative Advantage.
- CID Working Paper No. 276
- Hidalgo CA, Hausmann R. The building blocks of economic complexity. Proc Natl Acad Sci USA 2009;106(26):10570–5. http://dx.doi.org/10.1073/pnas.
- 19 Hidalgo CA, Klinger B, Barabási A-L, Hausmann R. The product space conditions the development of nations. Science (Wash D C) 2007;317(5837):482–7. http://dx.doi.org/10.1126/science.1144581.
- ICSU, ISSC, 2015.Review of the Sustainable Development Goals: The Science Perspective. Paris: International Council for Science (ICSU). ISBN: 978-0-930357-97-9
- International Council for Science (ICSU), 2017. A Guide to SDG Interactions: from Science to Implementation [D.J. Griggs, M. Nilsson, A. Stevance, D. McCollum (eds)]. International Council for Science, Paris. DOI: 10.24948/2017.01
- Le Blanc, D., 2015. Towards Integration at Last? The Sustainable Development Goals as a Network of Targets. Sustainable Development, 23, pp. 176-187. DOI: 10.1002/sd.1582
- Liu, J., Hull, V., Godfray, H.C.J., Tilman, D., Gleick, P., Hoff, H., Pahl-Wostl, C., Xu, Z., Chung, M.G., Sun, J., Li, S., 2018Nexus approaches to global sustainable development. Nature Sustainability, Volume 1, pp. 466-476. https://doi.org/10.1038/s41893-018-0135-8
- Lusseau, D., Mancini, F., 2018. Income-based variation in Sustainable Development Goal interaction networks. Nature Sustainability. https://doi.org/10.1038/s41893-019-0231-4
- Karnib, A., 2017. Mapping the direct and indirect interlinkages across the sustainable development goals: A qualitative nexus approach. International Journal of Development and Sustainability, Volume 6, No. 9, pp. 1150-1158.
- Maes, M., Jones, K., Toledano, M. Milligan, B., 2019. Mapping synergies and trade-offs between urban ecosystems and the sustainable development goals. Environmental Science and Policy, 93, pp. 181 -188. https://doi.org/10.1016/j.envsci.2018.12.010
- McGowan, P.J.K., Stewart, G.B., Long, G., Grainger, M.J., 2018. An imperfect vision of indivisibility in the Sustainable Development Goals. Nature Sustainability, Brief Communication. https://doi.org/10.1038/s41893-018-0190-1
- McCollum, D.L., Gomez, L., Busch, S., Pachauri, S., Parkinson, S., Rogelj, J., Krey, V., Minx, J.C., Nilsson, M., Stevance, A-S., Riahi, K., 2018. Connecting the sustainable development goals by their energy inter-linkages. Environmental Research Letters 13. https://doi.org/10.1088/1748- 9326/aaafe3

- Moyer, J., Bohl, D., 2019. Alternative pathways to human development: Assessing trade-offs and synergies in achieving the Sustainable Development Goals. Futures, 105, pp.199-210. https://doi.org/10.1016/j.futures.2018.10.007
- Nerini, F., Tomei, J., Seng To, L., Bisaga, I., Parikh, P., Black, M., Borrion, A., Spataru, C., Castán, V., Anandarajah, G., Milligan, B., Mulugetta, Y., 2017. Mapping synergies and trade-offs between energy and the Sustainable Development Goals. Nature Energy. https://doi.org/10.1038/s41560- 017-0036-5
- Nilsson, M., Griggs, D., Visbeck, M., 2016. Map the interactions between Sustainable Development Goals. Nature, Volume 534, pp. 320-322.
- Nilsson, M., Chisholm, E., Griggs, D., Howden-Chapman, P., McCollum, D., Messerli, P., Neumann, B., Stevance, A-S, Visbeck, M., Stafford-Smith, M., 2018. Mapping interactions between the sustainable development goals: lessons learned and ways forward. Sustainability Science, 13, pp. 1489-1503. https://doi.org/10.1007/s11625-018-0604-z
- Ourens, G., 2012. Uuruguay al espajo: Análisis de la estructura productiva uruguaya a través del Métdo de los Reflejos. Revista de Economía, Vol. 19, Nº 1, Mayo 2012. ISSN: 0797-5546.
- Pedrosa-Garcia, J.A., 2018. Mapping Synergies and Tradeoffs in the Sustainable Development Goals Network: A Case Study from Jordan. Economic and Social Commission for Western Asia (ESCWA). E/ESCWA/SDD/2017/WP.2
- Sachs, J., Schmidt-Traub, G., Kroll, C., Lafortune, G., Fuller, G., 2018. SDG Index and Dashboards Report 2018. New York: Bertelsmann Stiftung and Sustainable Development Solutions Network(SDSN). http://sdgindex.org/reports/2018/
- Salvia, A., Leal Filho, W., Brandli, L., Griebeler, J., 2019. Assessing research trends related to Sustainable Development Goals: local and global issues. Journal of Cleaner Production, 208, pp. 841-849. https://doi.org/10.1016/j.jclepro.2018.09.242
- Scherer, L., Behrens, P., de Koning, A., Heijungs, R., Sprecher, B., Tukker, A., 2018.Trade-offs between social and environmental Sustainable Development Goals. Environmental Science and Policy, 90, pp. 65-72. https://doi.org/10.1016/j.envsci.2018.10.002
- Schmidt-Traub, G., Kroll, C., Teksoz, K., Durand-Delacre, D., Sachs, J., 2017. National baselines for the Sustainable Development Goals assessed in the SDG Index and Dashboards. Nature Geoscience, Vol.10, pp. 546-556. DOI: 10.1038/NGEO2985
- Singh, G., Cisneros-Montemayor, A.M., Swartz, W., Cheung, W., Guy, J.A., Kenny, T-A., McOwen, C.J., Asch, R., Geffert, J.L., Wabnitz, C., Sumaila, R., Hanich, Q., Ota, Y., 2018. A rapid assessment of co-benefits and trade-offs among Sustainable Development Goals. Marine Policy, 93, pp. 223-231. http://dx.doi.org/10.1016/j.marpol.2017.05.030
- Taylor, P., Abdalla, K., Quadrelli, R., Vera, I., 2017. Better energy indicators for sustainable development. Nature Energy, 2, pp.1-4. DOI: 10.1038/nenergy.2017.117
- United Nations, Synthesis of voluntary national reviews 2016. Department of Economic and Social Affairs, New York, 2016.
- United Nations, Report of the Open Working Group of the General Assembly on Sustainable Development Goals, A/68/970: New York, 2014
- UNCTAD (United Nations Conference on Trade and Development): World investment report. 2014 https://unctad.org/en/PublicationsLibrary/wir2014_en.pdf
- United Nations, General Assembly: Transforming our world: the 2030 Agenda for Sustainable Development, A/RES/70/1: New York, 2015.
- Vaillant M, Ferreira-Coimbra N. Evolución del espacio de productos exportados: ¿está Uruguay en el lugar equivocado? Germany: University Library ofMunich;2009. https://mpra.ub.unimuenchen.de/47286/1/MPRA_paper_47286.pdf.
- Vladimirova, K., Le Blanc, D., 2016. Exploring Links Between Education and Sustainable Development Goals Through the Lens of UN Flagship Reports. Sustainable Development. DOI: 10.1002/sd.1626
- Weitz, N, Carlsen, H., Nilsson, M., Skanberg, K., 2018. Towards systemic and contextual priority setting for implementing the 2030 Agenda. Sustainable Sciences, 13, pp. 531-548

https://doi.org/10.1007/s11625-017-0470-0

- Zelinka, D., & Amadei, B. (2019). Systems Approach for Modeling Interactions Among the Sustainable Development Goals Part 1. International Journal of System Dynamics Applications, 8(1), 23–40. doi:10.4018/ijsda.2019010102