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# On the Relationship Between ISO Standards and Sustainable Development

## O relacji pomiędzy standardami ISO a zrównoważonym rozwojem

**Enriko Ceko**

*Canadian Institute of Technology,*
*Street Xhanfize Keko 12, Tirana, Albania*
*E-mail: enrikoceko@yahoo.co.uk*

## Abstract

The survival of humans and other organisms requires healthy ecosystems and environments. Towards the sustainability path, a social challenge, entailing international and national law, urban planning and transport, supply chain management local and individual lifestyles, and ethical consumerism is needed. International Standards Organization is working on matching SD Goals with ISO standards. The main goal of conducting this research was to clarify the relations between sustainable development and quality management. This was done by handling a regression analysis between the Sustainable development goals Index and ISO Standards Index to verify Hypothesis H1 (There is not any relation between SDG Index and ISO 9001 Index) against Hypothesis H0 (There is a strong relation between SDG Index and ISO 9001 Index). The results of the research are that scientific management of factors of production creates opportunities for long-term sustainable development, guaranteeing future generations' normal life and society's wealth, promoting economic growth, and quality life improvement, without damaging the environment, applying quality management principles and ISO standards, as efficient and effective tools, and this is needed immediately. On the other hand, scientific management of factors of production requires ISO standards application, so, a connection and relations between sustainable development and ISO standards, should exist. The general outcome of the research (also the practical and social outcome, as well as contribution to the field), is that looking forward to achieving and maintaining sustainable development scenarios, for all interested parties, individuals, public and private institutions, decision-makers, and civil society, applying quality management principles and ISO standards, as efficient and effective tools, as an immediate need, all parties should look forward to making sure building relations and connections between SDG and ISO standards, a connection which currently doesn't exist.

**Keywords:** sustainable development, quality management, ISO standards, ISO standards Index

## Streszczenie

Przetrwanie ludzi wymaga zdrowych ekosystemów i środowisk. W kierunku ścieżki zrównoważonego rozwoju prowadzi wyzwanie społeczne, obejmujące prawo międzynarodowe i krajowe, urbanistykę i transport, zarządzanie łańcuchem dostaw, lokalny i indywidualny styl życia oraz etyczny konsumpcjonizm. Międzynarodowa Organizacja Normalizacyjna pracuje nad dopasowaniem Celów SD do standardów ISO. Głównym celem przeprowadzenia tych badań było wyjaśnienie relacji między zrównoważonym rozwojem a zarządzaniem jakością. Dokonano tego, przeprowadzając analizę regresji między Indeksem celów zrównoważonego rozwoju a Indeksem norm ISO, aby zweryfikować Hipotezę H1 (Nie ma żadnego związku między Indeksem SDG a Indeksem ISO 9001) z Hipotezą H0 (Istnieje silny związek między Indeksem SDG a Indeksem ISO 9001). Wyniki badań wskazują, że naukowe zarządzanie czynnikami produkcji stwarza możliwości długoterminowego, zrównoważonego rozwoju, gwarantującego normalne życie przyszłym pokoleniom i bogactwo społeczeństwa, sprzyjającego wzrostowi gospodarczemu i poprawie jakości życia bez szkody dla środowiska, stosując jakość zasad zarządzania i norm ISO, jako skutecznych i skutecznych narzędzi, a to jest potrzebne natychmiast. Z drugiej strony naukowe zarządzanie czyn-

nikami produkcji wymaga stosowania norm ISO, dlatego powinien istnieć związek i relacje między zrównoważonym rozwojem a normami ISO. Ogólnym wynikiem badań (również rezultatem praktycznym i społecznym, a także wkładem w dziedzinę) jest oczekiwanie na osiągnięcie i utrzymanie scenariuszy zrównoważonego rozwoju dla wszystkich zainteresowanych stron, osób prywatnych, instytucji publicznych i prywatnych, decydentów i społeczeństwa obywatelskiego, poprzez stosowanie zasady zarządzania jakością i normy ISO, jako wydajnego i skutecznego narzędzia. Wszystkie strony powinny dążyć do zapewnienia budowania relacji i powiązań między standardami SDG i normami ISO, połączenia, który obecnie nie istnieje.

**Słowa kluczowe:** zrównoważony rozwój, zarządzanie jakością, standardy ISO, Indeks standardów ISO

## 1. Introduction

In this critical analysis article on the issue of sustainability studies, the relations between Sustainable Development Goals and International Standards of quality management are investigated, as they are important factors in healthy ecosystems and the environment.
There is supposed to be a strong relationship between sustainable development and quality management principles, especially with ISO standards.
This was the main question investigated in this research, using quantitative methods, combined with a regression analysis on relations between Sustainable Development Goals Index and the ISO Standards Index.
Separated existing data and materials about sustainable development, quality management, and ISO standards, existed before, together with previously published works and scholarly articles books, as well as online libraries, too.
It is believed that scientific management, including quality management, creates opportunities for long-term sustainable development, guaranteeing future generations' normal life and society's wealth, promoting economic growth, and quality life improvement, without damaging the environment, in a time when factors of production are more and more vulnerable against risks of misuse, damage, pollution, corruption, etc., so, applying in practice quality management principles and ISO standards, is needed immediately.
To achieve and maintain sustainable development scenarios, and to achieve United Nations Sustainable Development Goals 2030 Agenda, for all interested parties, individuals, and public and private institutions, especially for decision-makers and civil society, an improvement of the situation is needed, since there is a lack of methods, systems, techniques of use, and management of production's factors and lack of quality management principles and standardizations, too, application of ISO standards included, missing as higher education institutions programs, and subjects.
Strong and sustained relations exist between quality management / ISO standards and doing business climate.
Strong and sustained relations exist when doing business climate and life quality is verified already scientifically.
Improving quality management systems / respecting ISO standards parallel with doing business regulations / doing business climate, can improve the life quality of citizens.
Worldwide countries are recently facing problems affecting businesses' development and performance, development and economic growth, sustainable development, and life quality.
Improving quality institutions, quality infrastructure, and doing business climate worldwide, using ISO standards, will have a positive impact on increasing economic growth and improving the quality of life of citizens in a wider perspective, as a part of long-term sustainable development.

## 2. Material and methods

### *2.1. Sustainability and sustainable development*

The name sustainability is derived from the Latin sustinere (tenere, to hold; sub, under). Sustain can mean *maintain, support,* or *endure*. Sustainability is the process of maintaining change in a balanced environment, in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations (Ceko, 2011). For many in the field, sustainability is defined through the following interconnected domains or pillars: environment, economic and social (Capra, 2015). Sub-domains of sustainable development have been considered also: cultural, technological, and political (James et al., 2015).
Healthy ecosystems and environments are necessary for the survival of humans and other organisms. Ways of reducing negative human impact are environmentally-friendly chemical engineering, environmental resources management, and environmental protection, etc., (Bakari, 2017), applying standards, those of ISO included.
Moving towards sustainability is also a social challenge that entails international and national law, urban planning and transport, supply chain management (Maditati et al., 2018) local and individual lifestyles, and ethical consumerism. Ways of living more sustainably can take many forms from reorganizing living conditions (e.g., eco-villages, eco-municipalities, and sustainable cities), reappraising economic sectors (permaculture, green building,

sustainable agriculture), or work practices (sustainable architecture), using science to develop new technologies (green technologies, renewable energy), to adjustments in individual lifestyles that conserve natural resources (Maditati et al., 2018).
The term *sustainability* should be viewed as humanity's target goal of human-ecosystem equilibrium (homeostasis), while *sustainable development* refers to the holistic approach and temporal processes that *lead us to the end point of sustainability* (Shaker, 2015). Despite the increased popularity of the use of the term *sustainability*, the possibility that human societies will achieve environmental sustainability has been and continues to be, questioned – in light of environmental degradation, climate change, overconsumption, population growth, and societies' pursuit of unlimited economic growth in a closed system (WI & Assadourian, 2013).

Table 1. Three states of consumption of natural resources, environment, and sustainability, source: (Handbook of Economics, 2002)

| Consumption of natural resources | State of environment | Sustainability |
|---|---|---|
| More than nature's ability to replenish | Environmental degradation | Not sustainable |
| Equal to nature's ability to replenish | Environmental equilibrium | Steady-state economy |
| Less than nature's ability to replenish | Environmental renewal | Environmentally sustainable |

Sustainable development is the organizing principle for meeting human development goals while at the same time sustaining the ability of natural systems to provide the natural resources and ecosystem services upon which the economy and society depend. The desired result is a state of society where living conditions and resource use continue to meet human needs without undermining the integrity and stability of the natural system. Sustainable development can be classified as development that meets the needs of the present without compromising the ability of future generations. While the modern concept of sustainable development is derived mostly from the 1987 Brundtland Report, it is also rooted in earlier ideas about sustainable forest management and twentieth-century environmental concerns. As the concept developed, it shifted to focus more on economic development, social development, and environmental protection for future generations. It has been suggested that the term *sustainability* should be viewed as humanity's target goal of human-ecosystem equilibrium (homeostasis), while *sustainable development* refers to the holistic approach and temporal processes that lead us to the end point of sustainability (Shaker, 2015).
Modern economies are endeavoring to reconcile ambitious economic development and obligations of preserving natural resources and ecosystems, as the two are usually seen as conflicting in nature. The economic development brought by such organized principles and practices in an economy is called Managed Sustainable Development (MSD).
In 1987 the United Nations World Commission on Environment and Development released the report Our Common Future, commonly called the Brundtland Report. The report included what is now one of the most widely recognized definitions of sustainable development. Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- The concept of *needs*, in particular, the essential needs of the world's poor, to which overriding priority should be given.
- The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs (WCED, 1987).

*2.2 Sustainable Development Goals (SDGs)*
In September 2015, the United Nations General Assembly formally adopted the *universal, integrated, and transformative* 2030 Agenda for Sustainable Development, a set of 17 Sustainable Development Goals (SDGs). The goals are to be implemented and achieved in every country from the year 2016 to 2030. The Sustainable Development Goals (SDGs) are the current harmonized set of seventeen future international development targets. The Official Agenda for Sustainable Development adopted on 25 September 2015 has 92 paragraphs, with the main paragraph (51) outlining the 17 Sustainable Development Goals and its associated 169 targets (UN, 2015).

*2.3. Measuring sustainability. Sustainable development report*
Sustainability measurement is the quantitative basis for the informed management of sustainability. The metrics used for the measurement of sustainability (involving the sustainability of environmental, social, and economic domains, both individually and in various combinations) are evolving: they include indicators, benchmarks, audits, sustainability standards, and certification systems like Fairtrade and Organic, Indexes and accounting, as well as assessment, appraisal, and other reporting systems.
Some of the best-known and most widely used sustainability measures include corporate sustainability reporting, Triple Bottom Line accounting, World Sustainability Society, Circles of Sustainability, and estimates of the quality

of sustainability governance for individual countries using the Environmental Sustainability Index and Environmental Performance Index, while currently, as per the United Nations Sustainable Development Goals Report, a new Index has been introducing, called Sustainable Development Goals Index, under which countries are ranked based on SD Goals achievement.
The Sustainable Development Report (formerly the SDG Index & Dashboards) is a global assessment of countries' progress toward achieving sustainable Development Goals. It is a complement to the official SDG indicators and the voluntary national reviews.
All data presented in this report are based on the publication Sachs et al. (2022): From Crisis to Sustainable Development: the SDGs as Roadmap to 2030 and Beyond. Sustainable Development Report 2022. Cambridge: Cambridge University Press, as an assessment of each country's overall performance on the 17 SDGs, giving equal weight to each Goal (www.sdgIndex.org).
Countries are ranked by their overall score, which measures the total progress toward achieving all 17 SDGs (UN, 2015).

*2.4. International Standards Organization and Sustainability*
The International Organization for Standardization (ISO) refers to Sustainability as the ability to maintain or develop performance in the long term. Looking at it through a different lens, sustainability has to do with maintaining businesses financially, socially, and environmentally. Sustainability broadly consists of three components:
- Business Sustainability (economic/financial);
- Environmental Sustainability; and
- Social Responsibility.

Two types of ISO Standards are helpful for the successful implementation of Sustainability practices:
- Certifiable standards
- Guidance standards.

By supporting members to maximize the benefits of international standardization and ensure the uptake of ISO standards, the International Organization of Standards helps to meet the United Nations Sustainable Development Goals (SDGs). The economic, environmental, and societal dimensions are all directly addressed by ISO standards. Organizations and companies looking to contribute to the SDGs will find that International Standards provide effective tools to help them rise to the challenge (ISO, 2018, b).
As ISO (ISO, 2018, b) SDGs represent an ambitious plan to enhance peace and prosperity, eradicate poverty and protect the planet. They are recognized globally as essential to the future sustainability of our world. This plan of action calls on the contribution of all elements of society, including local and national governments, businesses, industries, and individuals. To be successful, the process requires consensus, collaboration, and innovation. ISO has published more than 22 000 International Standards and related documents that represent globally recognized guidelines and frameworks based on international collaboration. Built around consensus, they provide a solid base on which innovation can thrive and are essential tools to help governments, industry, and consumers contribute to the achievement of every one of the SDGs (ISO 2018, b). For each Goal, ISO has identified the standards that make the most significant contribution. With ISO standards covering almost every subject imaginable, from technical solutions to systems that organize processes and procedures, numerous ISO standards correspond to each of the SDGs (ISO, 2018, b), especially goal no 9: Industry, innovation, and infrastructure and also goals 3: Good health and well-being, 8: Decent work and economic growth, 11: Sustainable cities and communities 12: Responsible consumption and production (ISO, 2018, a). As per ISO (ISO, 2018, b) *ISO standards, the organization contributes to making the 2030 Agenda a reality, so no one is left behind*.

*2.5. Benefit from using ISO International Standards*
According to ISO (ISO, 2018, b) governments, industry, consumers, the economy, society, environment, can benefit from using ISO standards as per below:
- **Government**
  Regulators can rely on ISO standards as a solid base on which to create public policy that helps further SDG goals such as human rights, water, and energy efficiency, public health, and more. Recognized the world over, International Standards also help governments achieve their national and international commitments (ISO, 2018, b).
- **Industry**
  Industry plays a key role in achieving all the SDGs and ISO standards help it do that by providing guidelines and frameworks on everything, from employee health and well-being to energy consumption, to resilient and eco-friendly infrastructures (ISO, 2018, b).
- **Consumers**
  While contributing to the SDGs ranks high on the agenda of business leaders and politicians, many of the benefits are felt at the local community level. Reduced poverty, improved health, cleaner, and more abun-

dant water and safe and secure infrastructures are just some of the benefits to be gained from implementing ISO standards (ISO, 2018, b).

- **Economic**
  ISO International Standards promote economic sustainability by facilitating international trade, improving a country's national quality infrastructure, and supporting sustainable business practices (A quality infrastructure is a system contributing to governmental policy objectives in areas including industrial development, trade competitiveness in global markets, efficient use of natural and human resources, food safety, health, the environment, and climate change). They cover everything from efficient farming methods to anti-bribery management systems (ISO, 2018, b).
- **Social**
  ISO International Standards promote social sustainability by helping countries and communities improve the health and well-being of their citizens. They cover all aspects of social welfare, from healthcare systems and related products to social inclusion and accessibility (ISO, 2018, b).
- **Environmental**
  ISO International Standards promote environmental sustainability by helping businesses and countries manage their environmental impact. They cover such aspects as implementing an environmental management system, measuring and reducing greenhouse gas emissions and energy consumption, and encouraging responsible consumption (ISO, 2018, b).

The United Nation's (UN) 17 Sustainable development goals (SDGs) act as a blueprint for achieving a better and more sustainable future for everyone, addressing issues such as poverty, climate change, environmental degradation, and prosperity. The SDGs are interconnected and ask for all countries, no matter their economic status, to address climate change and environmental issues whilst promoting economic and social prosperity. The UN firmly believes that these goals are achievable by 2030 if everyone works together, from entire countries to local governments, private businesses to individuals. However, three years into the 15-year plan, there is concern that not enough is being done to meet the targets (QMSI, 2018).

Sustainable development can be defined as a form of development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This cannot be achieved by individual organizations working in silos, which is why 193 countries have pledged their support towards the 17 United Nations Sustainable Development Goals (UN SDGs) and their 169 targets. Adopted in 2015, the SDGs are a set of aspirational goals to end poverty, protect the planet, and ensure prosperity for all, as part of the United Nations 2030 Agenda for Sustainable Development (QMSI, 2018).

*2.6. Quality management, doing business, and global trends on ISO certificates*

Quality management is the act of overseeing all activities and tasks needed to maintain a desired level of excellence. This includes creating and implementing quality planning and assurance, as well as quality control and quality improvement. Quality management ensures that an organization, product, or service is consistent. It has four main components: quality planning, quality assurance, quality control, and quality improvement (Rose, 2005). Quality management is focused not only on product and service quality but also on the means to achieve it. Quality management, therefore, uses quality assurance and control of processes as well as products to achieve more consistent quality. Several means to achieve quality management are between doing business regulations and rules, ISO certificates included, which are focused more on the quality of procedures private and public subjects follow, which at the end of the day brings a higher quality of products and services (Ceko, 2013).

Because societies need regulation – and businesses, as part of society, are no exception, ISO certificates finally are part of business and trade regulations since they are the minimum requisites for characteristics of processes, products, and services to be used by private and public entities/subjects to be acceptable from their clients and markets. Without these standards, modern private and public entities cannot exist. And where markets left without standards, they would produce poor outcomes and finally low life quality for citizens. When starting a new business, or entering a new phase of enterprise development, entrepreneurs need to establish certain procedures and standards, allowing the business to live beyond minimum frontiers, to export and import, to participate in public procurement procedures, and finally to attract as much as possible clients, for higher profits and achieving other business objectives. Standards are the heart of all these issues, facilitating business transactions and allowing businesses to operate effectively. With 1 609 294 certificates issued worldwide in 2014, there is a slight up in the previous year, which demonstrates a moderate growth for almost all the ISO management systems standards around the world (ISO, 2014), confirming trends observed over the last two years. This market stabilization is, however, offset by three good performers exhibiting more sustained growth. Albeit less impressive than in previous years, ISO 50001 for energy management demonstrates a 40 % growth rate, led once again by Germany, responsible for 50 % of the 6 778 certificates reported. Similarly, food management standard ISO 22000 continues to deliver reliable performance with a 14 % growth rate, while ISO 16949 for the automotive sector shows accelerated progression with a commendable 8 %, signaling that economic recovery in the auto industry is holding up (ISO, 2014).

Table 2. ISO Survey Executive Summary, source: (ISO, 2020)

| ISO standards | Total valid certificates | Total number of sites |
|---|---|---|
| **ISO 9001 – QMS** | 916,842 | 1,299,837 |
| **ISO 14001 – EP** | 348,473 | 568,798 |
| **ISO 45001 – HSW** | 190,481 | 251,191 |
| **ISO/IEC 27001 – ISM** | 44,499 | 84,181 |
| **ISO 22000 – QSGF** | 33,741 | 39,894 |
| **ISO 13485 – H** | 25,656 | 34,954 |
| **ISO 50001 – EE** | 19,731 | 45,092 |
| **ISO 20000-1 – IT** | 7,846 | 9,927 |
| **ISO 22301 – BC** | 2,205 | 4,662 |
| **ISO 37001 – ABMS** | 2,065 | 5,946 |
| **ISO 39001 – RTS** | 972 | 2,341 |
| **ISO 28000 – SRMS** | 520 | 968 |

When comparing with the 2019 edition, the results are consistent when looking at the overall figures for most of the countries. The overall results show an increase, from 2019, of 18% in the total number of valid certificates for the 12 management system standards covered in the survey. Part of this significant increase is due to the important growth in the certification to ISO 45001; this standard was published in 2018 and consequently had a limited number of certifications in the previous edition of the survey. The rate of increase for ISO 9001 and ISO 14001 has been greater compared to previous years with +4% for ISO 9001 and + 12% for ISO 14001 mainly due to an important increase in China. Similarly, to the previous editions of the survey, the results show some fluctuations at the country level that are explained by factors related to participation such as the non-participation of some certification bodies for those specific countries. In the 2020 survey, this is the case, particularly for ISO 9001 and ISO 14001 for Belgium, Korea, Mexico, Ireland, and the Philippines, and for ISO 28000, for China (ISO, 2020). The most important thing related to this paper is the declaration of the International Standards Organization that the ISO Survey is not a database, but just a list of ISO certificates issued and a list of countries based on alphabetic order, neither based on the number of certificates issued per country (ISO, 2020).

*2.7. Sustainable Development and quality management higher education Institutions programs*

Besides, in several higher education institutions mostly in Europe, the United Kingdom, the United States, China, etc., impressive work is then done on the improvement of their higher educational institutions' curricula, there is still a lack of subjects related to the environment, ecology, sustainable development, quality management, and other subjects and modules related to them in higher education institutions around the world, especially in Latin America, Africa, Middle East, etc. Higher education institutions in fields, specifically the fields of environment, economy, law, and engineering, have to work hard to prepare programs, curricula, and syllabi in the field of environment, ecology, sustainable development, quality management, etc., to offer interdisciplinary subjects and modules where skills, knowledge, and competencies related the to the environment, ecology, sustainable development, and quality management should have been integrated (Ceko, 2021).

*2.8. Methodology and methods (Research framework, the purpose of the case study)*

The framework of the research was the relationship between the Sustainable Development Goals Index and the ISO Standards Index from a global perspective and global ecosystem.

Given the lack of numerical, statistical, and algebraic arguments on relations between the SDG Index and the ISO Standards Index, this study adopts a theory-building mode and aims to investigate the following research questions:

1 Ho: There is a strong connection/relation between SDG Index and the ISO Standards Index.

2 H1: There is not a string connection/relation between SDG Index and the ISO Standards Index.

Considering that there are few types of research on the relations between the SDG Index and the ISO standards Index, listed in the literature review of this paper research, and considering that theoretical approaches on relations between sustainable development and ISO standards, and specifically between SDG Index and ISO standards Index, as well as numerical, statistical and algebraic arguments on relations between them doesn't exist.

Specifically, while acknowledging the importance of connections/relations between sustainable development (SD goals) and ISO standards, prior empirical research impresses with declarations that this connection exists, but does not explain statistically if there is any connection/relation between them, thus, a theory building was needed, supported by analysis and evidence. For this, with this critical analysis article, an exploratory approach was adopted, using a single in-depth case study approach, appropriate for building an in-depth understanding of a phenomenon and allowing closer investigation of theoretical constructs.

*2.8.1. Case selection*

The case was selected based on three main criteria: (1) a theoretical approach, (2) suitability of relations, and (3) practical positive impacts on relations between the SDG Index and the ISO Standards Index.
The case project ran in stages: (1) identifying needs for sustainable development, (2) identifying needs for quality management, and ISO standards certification, (3) identifying the rank of the countries for SDG and Rank of countries for ISO standards Index.

*2.8.2. Data collection*

Data for SDG Index has been gathered from the SD Report 2021 (UNSDG. 2021), an annual ranking of countries by their achievement of fulfilling 17 SDGs of Agenda 2030.
Data for the ISO Standards Index has been gathered from the ISO Certificates Report 2021 (ISO, 2021).
Data for several businesses registered worldwide has been gathered from HitHorizon (HitHorizon, 2021).
To prepare the ISO standards Index I have divided the number of ISO certificates issued per country by the number of businesses registered in the country, resulting in the ISO standards Index per country, preparing the list of countries based on this Index.

*2.8.3. Data analysis*

A correlation and regressive analysis (inferential statistics) between these Indexes for 134 countries worldwide were performed.
In the table below, 134 countries are listed for SDG Index (taken from UNSDG Report), and for the ISO Standards Index (prepared by the author of this article as per the explanation given in the paragraph above).
Based on these data and information from secondary resources, a regression between SDG Index and ISO certificates issued per country was built. Data from ISO about ISO standards certificates issued worldwide (taken from ISO reports) don't help directly, because an Index is needed, so I build the Index by dividing the number of ISO standards certificates issued per country by the number of business entities in the country, finding the ISO standards Index, as explained above.

## 3. Results and Discussion

After listing countries per this Index, I performed a regression analysis between ISDG Index and ISO Standards Index, based on which, the relations between the ISDG Index and ISO Standards Index are not high, verifying the H1 hypothesis which was: *There is not any relation between ISDG Index and ISO Standards Index*, against H0 that was: *There is a strong relation between ISDG Index and ISO Standards Index*.
In the table below, countries are listed as per the SD Index, which served as the *Y* at the regression procedures, and ISO standard Index which served as the *X* at regression procedures, handled in an Excel program.
In the graphic below a correlation analysis, in a graphical mode is given, where is shown there is no connection/relation between the SDG Index and the ISO Standards Index.

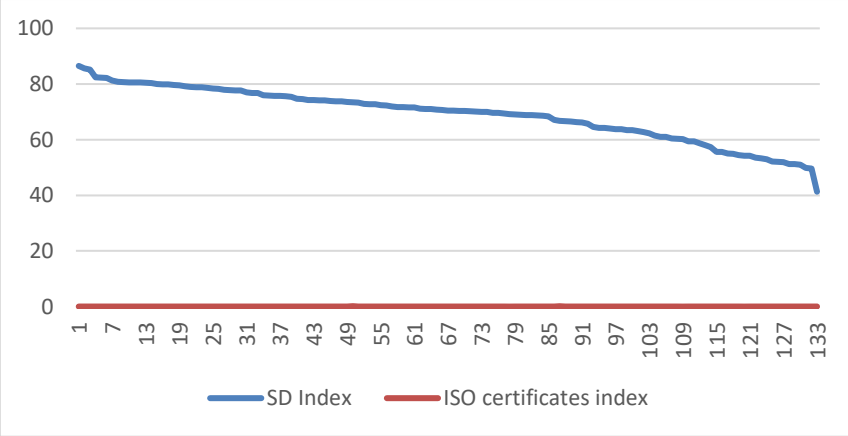


Figure 1. Missing relations between the SDG Index and the ISO Standards Index, own calculation

In Tables 4-6 statistical results about missing connections/relations between the SDG Index and the ISO Standards Index are given, where $R^2 = 0.280905$ shows a weak connection/relation between these two Indexes.

Table 3. List of countries based on the SDG Index and ISO Standards Index, own calculation

| No | Country | SD Index | ISO standards Index | No | Country | SD Index | ISO standards Index |
|---|---|---|---|---|---|---|---|
| 1 | Finland | 86.51 | 0.0082 | 59 | Singapore | 71.72 | 0.0153 |
| 2 | Denmark | 85.63 | 0.0071 | 60 | Albania | 71.63 | 0.0043 |
| 3 | Sweden | 85.19 | 0.00575 | 61 | Algeria | 71.54 | 0.00034 |
| 4 | Norway | 82.35 | 0.00695 | 62 | Kazakhstan | 71.14 | 0.002 |
| 5 | Austria | 82.32 | 0.0173 | 63 | Armenia | 71.05 | 0.00124 |
| 6 | Germany | 82.18 | 0.021 | 64 | Maldives | 71.03 | 0.006 |
| 7 | France | 81.24 | 0.0054 | 65 | Domncn Rep | 70.76 | 0.00311 |
| 8 | Swiss | 80.79 | 0.022 | 66 | Tunisia | 70.69 | 0.00212 |
| 9 | Ireland | 80.66 | 0.0136 | 67 | Bhutan | 70.49 | 0.00189 |
| 10 | Estonia | 80.62 | 0.0071 | 68 | Turkey | 70.41 | 0.00132 |
| 11 | UK | 80.55 | 0.00884 | 69 | Malaysia | 70.38 | 0.0115 |
| 12 | Poland | 80.54 | 0.00656 | 70 | Barbados | 70.34 | 0.00094 |
| 13 | Czech Rep. | 80.47 | 0.0207 | 71 | Mexico | 70.2 | 0.00209 |
| 14 | Latvia | 80.28 | 0.01173 | 72 | Colombia | 70.13 | 0.00558 |
| 15 | Slovenia | 79.95 | 0.0127 | 73 | Sri Lanka | 70.03 | 0.0019 |
| 16 | Spain | 79.9 | 0.0146 | 74 | Uzbekistan | 69.93 | 0.00075 |
| 17 | Netherlands | 79.85 | 0.0072 | 75 | Tajikistan | 69.68 | 0.008 |
| 18 | Belgium | 79.69 | 0.00467 | 76 | Salvador | 69.6 | 0.00147 |
| 19 | Japan | 79.58 | 0.01123 | 77 | Jordan | 69.41 | 0.00282 |
| 20 | Portugal | 79.23 | 0.0114 | 78 | Indonesia | 69.16 | 1.8E-05 |
| 21 | Hungary | 79.01 | 0.00925 | 79 | Jamaica | 69.02 | 0.00406 |
| 22 | Iceland | 78.87 | 0.00203 | 80 | Morocco | 68.98 | 0.01886 |
| 23 | Croatia | 78.79 | 0.0149 | 81 | UAE | 68.84 | 0.01185 |
| 24 | Slovak Rep. | 78.66 | 0.0166 | 82 | Montenegro | 68.81 | 0.0146 |
| 25 | Italy | 78.34 | 0.021 | 83 | Egypt | 68.66 | 0.00094 |
| 26 | New Zeal. | 78.3 | 0.00321 | 84 | Iran | 68.59 | 0.0288 |
| 27 | Korea, Rep. | 77.9 | 0.0033 | 85 | Mauritius | 68.4 | 0.00203 |
| 28 | Chile | 77.81 | 0.0293 | 86 | Brunei Drsl | 67.1 | 0.0169 |
| 29 | Canada | 77.73 | 0.0052 | 87 | Qatar | 66.78 | 0.078 |
| 30 | Romania | 77.72 | 0.0144 | 88 | Philippines | 66.64 | 0.00544 |
| 31 | Uruguay | 77 | 0.0088 | 89 | S. Arabia | 66.56 | 0.00343 |
| 32 | Greece | 76.81 | 0.034 | 90 | Lebanon | 66.3 | 0.00354 |
| 33 | Malta | 76.77 | 0.00596 | 91 | Nepal | 66.18 | 0.00016 |
| 34 | Belarus | 75.99 | 0.0494 | 92 | Belize | 65.73 | 0.00038 |
| 35 | Serbia | 75.89 | 0.0189 | 93 | Kuwait | 64.53 | 0.039 |
| 36 | Luxembourg | 75.74 | 0.00231 | 94 | Bahrain | 64.27 | 0.0093 |
| 37 | Ukraine | 75.69 | 0.00121 | 95 | Bangladesh | 64.22 | 0.00126 |
| 38 | Australia | 75.58 | 0.00576 | 96 | Panama | 64 | 0.00536 |
| 39 | Lithuania | 75.42 | 0.0099 | 97 | Cambodia | 63.75 | 0.00028 |
| 40 | Cuba | 74.66 | 0.024 | 98 | S. Africa | 63.72 | 0.00196 |
| 41 | USA | 74.55 | 0.00095 | 99 | Ghana | 63.44 | 0.00317 |
| 42 | Bulgaria | 74.29 | 0.0129 | 100 | Lao PDR | 63.39 | 0.00054 |
| 43 | Cyprus | 74.23 | 0.0053 | 101 | Honduras | 63.07 | 0.00143 |
| 44 | Thailand | 74.13 | 0.00505 | 102 | Namibia | 62.72 | 0.00125 |
| 45 | Russian Fed. | 74.07 | 0.0019 | 103 | Iraq | 62.25 | 0.00721 |
| 46 | Moldova | 73.93 | 0.0012 | 104 | Botswana | 61.43 | 0.00106 |
| 47 | Costa Rica | 73.76 | 0.00428 | 105 | Guatemala | 61 | 0.0164 |
| 48 | Kyrgyz Rep | 73.72 | 0.01179 | 106 | Kenya | 60.96 | 0.00022 |
| 49 | Israel | 73.51 | 0.018 | 107 | Trnd & Tbg | 60.41 | 0.0048 |
| 50 | Azerbaijan | 73.45 | 0.144 | 108 | India | 60.32 | 0.00082 |
| 51 | Georgia | 73.35 | 0.01136 | 109 | Gambia | 60.17 | 2.6E-05 |
| 52 | Brazil | 72.8 | 0.00343 | 110 | Rwanda | 59.42 | 0.00039 |
| 53 | Argentina | 72.78 | 0.00951 | 111 | Pakistan | 59.34 | 0.022 |
| 54 | Vietnam | 72.76 | 0.0131 | 112 | Senegal | 58.7 | 0.00046 |
| 55 | China | 72.38 | 0.00434 | 113 | Ethiopia | 58.01 | 0.00113 |
| 56 | N. Macedonia | 72.31 | 0.0191 | 114 | Tanzania | 57.37 | 5.3E-05 |
| 57 | Peru | 71.93 | 0.00162 | 115 | Togo | 55.57 | 0.00036 |
| 58 | Bsni&Hrzgvn | 71.73 | 0.0195 | 116 | Cameroon | 55.55 | 0.00046 |

| No | Country | SD Index | ISO standards Index | No | Country | SD Index | ISO standards Index |
|---|---|---|---|---|---|---|---|
| 117 | Lesotho | 55.06 | 0.00006 | 126 | Yemen, Rep. | 52.08 | 0.025 |
| 118 | Uganda | 54.86 | 0.00014 | 127 | Haiti | 51.91 | 0.00008 |
| 119 | Burk. Faso | 54.47 | 0.00044 | 128 | Guinea | 51.27 | 0.00595 |
| 120 | Nigeria | 54.23 | 1.4E-05 | 129 | Benin | 51.24 | 0.01044 |
| 121 | Zambia | 54.16 | 0.00004 | 130 | Angola | 50.94 | 0.00251 |
| 122 | Mozambique | 53.57 | 0.01276 | 131 | Djibouti | 50.31 | 0.00882 |
| 123 | Malawi | 53.25 | 0.00215 | 132 | Liberia | 49.89 | 0.052 |
| 124 | Sierra Leone | 52.98 | 0.0004 | 133 | Sudan | 49.63 | 0.00833 |
| 125 | Niger | 52.2 | 0.00698 | 134 | Chad | 41.29 | 0.0082 |

Tables 4-6. Statistical results about missing connections/relations between the SDG Index and the ISO Standards Index, own calculation

| SUMMARY OUTPUT | |
|---|---|
| *Regression Statistics* | |
| Multiple R | 0.530005 |
| R Square | 0.280905 |
| Adjusted R Square | 0.27333 |
| Standard Error | 59.39674 |
| Observations | 133 |

| ANOVA | | | | | |
|---|---|---|---|---|---|
| | *df* | *SS* | *MS* | *F* | *Significance F* |
| Regression | 1 | 181917.1 | 181917.1 | 51.56419 | 4.65E-11 |
| Residual | 132 | 465692.5 | 3527.973 | | |
| Total | 133 | 647609.5 | | | |

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* | *Lower 95.0%* | *Upper 95.0%* |
|---|---|---|---|---|---|---|---|---|
| Intercept | 0 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A |
| ISO certificates index | 1957.2 | 272.5593 | 7.180821 | 4.53E-11 | 1418.05 | 2496.349 | 1418.05 | 2496.349 |

With these results, it has been verified in practice there is no connection/relation between the SDG Index and the ISO Standards Index.

In this critical analysis article, it was verified statistically, using a regressive analysis, that there is no relation between SDG Index and ISO Standards Index, but this doesn't mean the relations are not needed, or they can't be achieved in the future. The question is when these relations will be achieved and verified, and what is next.

It is true and we all, UN and ISO including do believe that SDGs can be achieved there is an improving ISO standards certification process all around the globe, the question is how we can better match SDGs with ISO standards.

Scientific management of factors of production creates opportunities for long-term sustainable development, guaranteeing future generations' normal life and society's wealth, promoting economic growth, and quality life improvement, without damaging the environment, applying quality management principles and ISO standards, as efficient and effective tools, and this is needed, immediately, but scientific management of factors of production requires ISO standards application in a wider approach and not only for private subjects which are looking to participate in public procurements and for exporting goods accompanied with ISO certificates, so, a real connection and relations between the Sustainable development goals Index (SDGI) and ISO standards should exist.

## 4. Implications for theory and practice, limitations, and further research

About the theory, based on the final results of this research, a new window has been opened for further research on the field of relations between sustainable development and quality management, especially between SDG

Index and ISO Standards Index, considering them as a tool for life quality improvement all around the world.
The contribution of this critical analysis article on the field of relations between sustainable development and ISO standards shows that international organizations, those mentioned in this paper, should carefully investigate the issue of building relations between concepts, especially between important concepts and principles like those of 17 UN SD Goals and Quality management principles too.
Further research is needed to verify these relations shall be strengthening in the future, to make SDGs and ISO standards real tools for life quality improvement all around the world.

## 1. Conclusions and recommendations

This critical analysis article emphasizes the economic and social importance of SDGs and ISO standards, for current and future generations. This research has been undertaken using plenty of data about the SDG Index and offering for the first time data about the ISO standards Index for the period of 2021.
The following conclusions may be drawn:

1. Scientific management of factors of production creates opportunities for long-term sustainable development, guaranteeing future generations' normal life and society's wealth, promoting economic growth, and quality life improvement, without damaging the environment, applying quality management principles and ISO standards, as efficient and effective tools, and this is needed, immediately.
2. Scientific management of factors of production requires ISO standards application, so, a connection and relations between the sustainable development goals Index (SDGI) and ISO Standards Index should exist, for healthier ecosystems and the environment for all.
3. The general outcome of the research is looking forward to achieving and maintaining sustainable development scenarios, for all interested parties, individuals, public and private institutions, decision-makers, and civil society, applying quality management principles and ISO standards, as efficient and effective tools, as an immediate need, all parties should look forward to making sure building relations and connections between SDG and ISO standards, which currently doesn't exist.
4. Higher education institutions in all fields, and specifically in the field of environment, economy, law, and engineering, have to work hard to prepare programs, curricula, and syllabi in the field of environment, ecology, sustainable development, quality management, etc., to offer interdisciplinary subjects and modules where skills, knowledge, and competencies related to the environment, ecology, sustainable development, and quality management should have been integrated.
5. There are no strong and sustain relations between sustainable development and quality management / ISO standards.
6. Improving quality management system / respecting ISO standards parallel with working on achieving sustainable development goals, shall have a real indication of life quality improvement all around the globe.
7. The contribution of the work to scientific research and its economic implications should be emphasized.

Further research is needed to verify these relations shall be strengthening in the future, to make SDGs and ISO standards real tools for life quality improvement all around the world.

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