Journal Industrial Engineering 8[20]1-9: e30820109
Article

Sustainable development goals and ISO standards in industrial maintenance

Objetivos de desarrollo sostenible y las normas ISO en el mantenimiento industrial

Herrera-Sánchez, Gustavo*[a], Morán-Bravo, Luz del Carmen[b], Silva-Juárez, Alejandro[c] and De Sampedro-Poblano, Héctor Manuel[d]

[a] Universidad Tecnológica de Puebla • F-6595-2018 • 0000-0001-5276-5062 • 59805
[b] Universidad Tecnológica de Puebla • G-2686-2018 • 0000-0002-7096-2075 • 75419
[c] Universidad Tecnológica de Puebla • F-6969-2018 • 0000-0001-8473-9803 • 637028
[d] Universidad Tecnológica de Puebla • Q-8174-2018 • 0000-0002-9235-9007 • 548477

CONAHCYT classification:

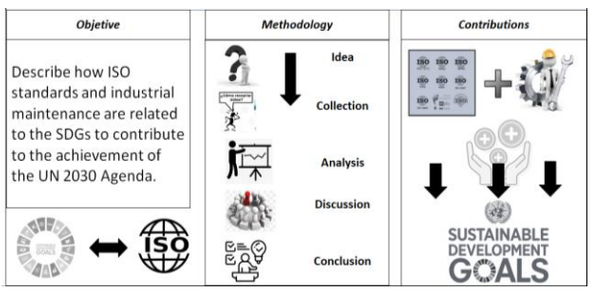
Area: Engineering
Field: Technological sciences
Discipline: Industrial Technology
Sub-discipline: Maintenance Engineering

https://doi.org/10.35429/JIE.2024.8.20.3.9
Article History:
Received: January 30, 2024
Accepted: December 31, 2024

* ✉ [pilar.jimenez@upvm.edu.mx]

Abstract

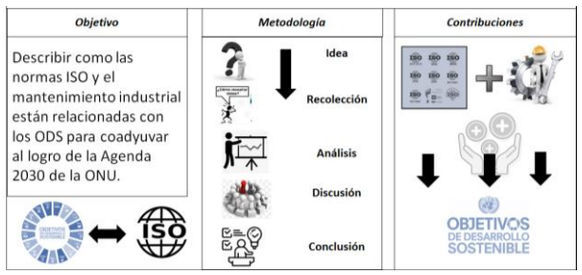
Currently, sustainability or sustainability is crucial for our planet and humanity, therefore, for companies, a response to this event is the Agenda 2030 of the United Nations that in 2015 designed a strategy through the SDGs to promote sustainable development, which is composed of three dimensions: economic, social and environmental. The objective of this analysis is to relate ISO standards and industrial maintenance for the achievement of the 167 goals of the SDGs to contribute to sustainable development by developing a research with a qualitative approach for the collection and analysis of information through an exploration of this relationship. The contribution of this article is to show how ISO standards contribute to the benefit of the SDGs and the actions taken by industrial maintenance, for example, ISO 55001 an asset management system has 0.04% of all certificates annealed by ISO, this leads us to new concepts such as green maintenance and sustainable maintenance.



SDS, ISO standard, sustainable maintenance

Resumen

En la actualidad, la sostenibilidad o sustentabilidad es crucial para nuestro planeta y la humanidad, por ende, para las empresas, una respuesta a este evento es la Agenda 2030 de la Naciones Unidas que el año 2015 diseño una estrategia mediante los ODS para promover el desarrollo sostenible, el cual está integrado por tres dimensiones la económica, social y ambiental. El objetivo de este análisis es relacionar las normas ISO y el mantenimiento industrial para el logro de las 167 metas de los ODS para coadyuvar al desarrollo sostenible desarrollando una investigación con un enfoque cualitativo para la recolección y análisis de la información a través de una exploración de esta relación. La contribución de este artículo es mostrar como las normas ISO contribuyen al beneficio de los ODS y las acciones tomadas por el mantenimiento industrial, por ejemplo, la norma ISO 55001 un sistema de gestión de activos tiene 0.04% de todos los certificados recocidos por la ISO, esto nos lleva a nuevos conceptos como el mantenimiento verde y el mantenimiento sostenible.



ODS, Normas ISO, Mantenimiento sustentable

Citation: Herrera-Sánchez, Gustavo, Morán-Bravo, Luz del Carmen, Silva-Juárez, Alejandro and De Sampedro-Poblano, Héctor Manuel. [2024]. Sustainable development goals and ISO standards in industrial maintenance. Journal Industrial Engineering. 8[20]-1-9: e10820109.

Introduction

Today, sustainability or sustainability is a transcendental element in decision making at strategic, tactical and operational levels in companies, the manufacture of a product or service, the acquisition of raw materials or services, the maintenance of their assets, among other things, because these activities positively or negatively affect sustainability.

Sustainable development enables nations and their companies to engage in a holistic process that brings together the social, ecological and economic dimensions. On the other hand, the UN Agenda 2030 for sustainable development generates a strategy towards the economic, social and environmental parts of sustainability, which involves 17 Sustainable Development Goals (SDGs) and 169 targets for the social, economic and environmental dimensions.

In this context, industrial maintenance is no stranger to these changes and new types of disruptive maintenance such as maintenance 4.0, maintenance 5.0 and sustainable maintenance are emerging.

The purpose of this study is to describe how ISO standards and industrial maintenance are related to the SDGs in order to contribute to the achievement of the UN 2030 Agenda. For this research, the qualitative approach is used for the collection and analysis of information through an exploratory investigation of this relationship.

Nowadays, companies are not indifferent to the 2030 Agenda, they must integrate and connect corporate sustainability and the SDGs for a frame of reference that involves them in this global context. With this argument, the industrial maintenance area must contemplate courses of action to privilege corporate sustainability and the SDGs, although it is true that this depends on the operating and commercial environment of companies, so it is important to reflect on their objectives, needs and processes for this contribution.

SDGs and Standardisation

The industrialisation of processes in companies has a significant effect on the pollution of ecosystems. This is not new, because since the first industrial revolution the impact on the environment has started and in this case, the maintenance area requires spare parts to carry out its activities from this point it is necessary that these supplies do not affect the environment and reduce the carbon footprint, because from a systems theory approach, see figure 1, the inputs and outputs contribute to the pollution of ecosystems, affect the economic and social aspect of the environment.

Box 1

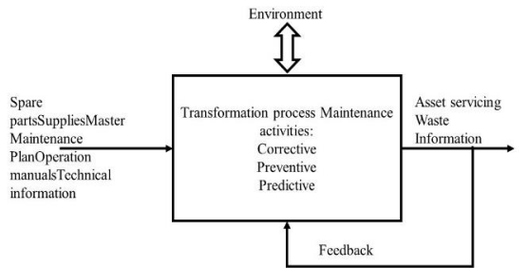


Figure 1
Maintenance Process

Source: Own elaboration

Therefore, spare parts management should optimise items and reduce inventory costs, all of this focused on sustainable industrial maintenance that allows the use of non-polluting products, proper use of water, efficiency in ventilation and heating systems, waste recycling in accordance with regulations, proper operation of machinery and policies that favour the environment.

In addition, reliable suppliers must be considered and their products must not pollute, for example, biodegradable lubricants that reduce pollution.

On the other hand, the SDGs are 17 goals promoted by the United Nations (UN) for the 2030 Agenda. According to Alison Smale (n.d.), the SDGs are defined as the world we aspire to have from various approaches and involve all nations to make that change.

It is imperative that the entire world's population, including governments, the private sector and citizens, play an active role in achieving these goals.

ISSN: 2523-0344
RENIECYT-CONAHCYT: 1702902

Herrera-Sánchez, Gustavo, Morán-Bravo, Luz del Carmen, Silva-Juárez, Alejandro and De Sampedro-Poblano, Héctor Manuel. [2024]. Sustainable development goals and ISO standards in industrial maintenance. Journal Industrial Engineering. 8[20]-1-9: e30820109. DOI:https://doi.org/10.35429/JIE.2024.8.20.3.9

According to the 2030 Agenda for Sustainable Development:

> 'It implies a common and universal commitment, however, as each country faces specific challenges in its quest for sustainable development, States have full sovereignty over their wealth, resources and economic activity, and each will set its own national targets, adhering to the Sustainable Development Goals (SDGs), provides the text adopted by the General Assembly'.

Table 1 briefly shows the 17 SDGs, the relationship between each one of them is vital because one of them cannot and should not be achieved without the others.

Box 2

Table 1
ODS short description

ODS	
1. The end of poverty	10. Reducing inequalities
2. Zero hunger	11. Sustainable cities and communities
3. Health and well-being	12. Responsible production and consumption
4. Quality education	13. Climate action
5. Gender equality	14. Underwater life
6. Clean water and sanitation	15. Terrestrial ecosystem life
7. Affordable and clean energy	16. Peace, justice and strong institutions
8. Decent work and economic growth	17. Partnership to achieve the goals
9. Industry, innovation and infrastructure	

Source Own elaboration based on SDGs - UN

The sustainable success of an organisation, region or country according to the ISO 9004: 2018 standard involves social, economic and ecological aspects as shown in Figure 2.

Box 3

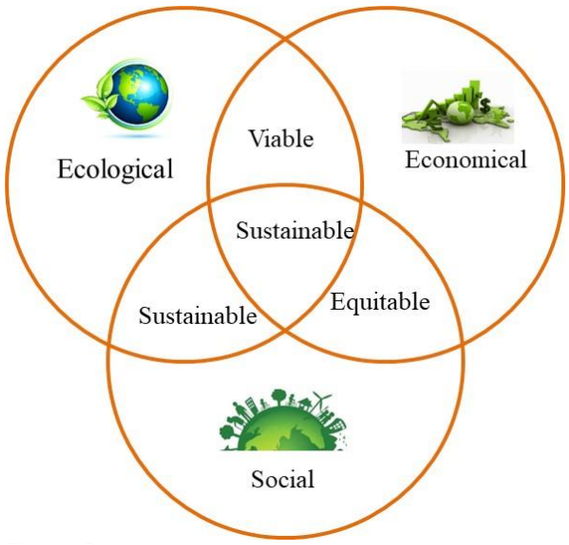


Figure 2
Sustainable success

Source: Eduardo Coraza (2018)

Standardisation is an important economic, environmental and social element globally, enabling local, regional, national and international trade between nations. Standardisation ensures that products manufactured anywhere in the world meet technical, health, environmental and legal requirements and guarantees competitiveness between companies and nations.

From an economic, social and ecological perspective (see figure 1), it promotes creativity and innovation for the improvement of products, processes and systems by complementing the regulation of laws between countries and is a reference for international markets through transparency.

Overall, standardisation will contribute to the achievement of the SDGs through the development of international, national, regional and local standards. There are different international standardisation bodies such as the International Electrotechnical Commission (IEC), the International Organization for Standardization (ISO), the Codex Alimentarius Commission, the International Bureau of Weights and Measures (BIPM), the International Organization of Legal Metrology (OIML), the International Telecommunication Union (ITU).

ISSN: 2523-0344
RENIECYT-CONAHCYT: 1702902

Herrera-Sánchez, Gustavo, Morán-Bravo, Luz del Carmen, Silva-Juárez, Alejandro and De Sampedro-Poblano, Héctor Manuel. [2024]. Sustainable development goals and ISO standards in industrial maintenance. Journal Industrial Engineering. 8[20]-1-9: e30820109. DOI:https://doi.org/10.35429/JIE.2024.8.20.3.9

There are also globally recognised standardisation bodies such as the American National Standards Institute (ANSI), the German Standards Institute (DIN), the Japanese Industrial Standards (JIS), the Spanish Association for Standardisation and Certification (AENOR), the British Standards Institution (BSI) to name but a few.

Therefore, standardisation offers ISO standards as tools to support the achievement of sustainable development as they can be fundamental for the company to include in its strategy the fulfilment of the SDGs and the contribution to a more sustainable world.

In Mexico, the General Directorate of Standards (DGN) under the Ministry of Economy is responsible for issuing and authorising mandatory standards, the Mexican Official Standards (NOM) through 10 government agencies and 8 decentralised entities. Voluntary Mexican Standards (NMX) through 11 national standardisation bodies such as NORMEX, Instituto Mexicano de Normalización y Certificación, A.C. (IMNC), Asociación de Normalización y Certificación, A.C. (ANCE), Instituto Nacional de Normalización Textil, A:C: (INNTEX), among others.

The relationship between the ISO standards and the SDGs are shown below (see table 2).

Box 4

Table 2

SDGs and ISO Standards

ODS	Number of ISO standards	Relevant ISO standard
End of poverty	441	ISO 20400 ISO 37001
Zero Hunger	631	ISO 22000 ISO 26000 ISO 20400
Health and welfare	3,864	ISO11137 ISO 7153 ISO 37101
Quality education	697	ISO21001
Gender equality	264	ISO 26000
Clean water and sanitation	783	ISO 24518 ISO 30500
Affordable and clean energy	1,223	ISO 50001 ISO 17225
Decent work and economic growth	3,014	ISO 45001
Industry, innovation and infrastructure	15,120	ISO 55000 ISO 44001
Reducing inequalities	719	ISO 26000
Sustainable cities and communities	2,963	ISO 37120 ISO 37122 ISO 37123
Responsible production and consumption	3,458	ISO 20400 ISO 15392
Climate action	1,539	ISO 14000
Underwater life	428	ISO 26000
Life of terrestrial ecosystems	1,266	ISO 38200
Peace, justice and strong institutions	273	ISO 37001
Partnerships to achieve the goals	-	-

Source: Own elaboration based on Sustainable Developments Goals - ISO

Table 2 shows each of the 17 SDGs in their short version, the second column indicates the number of standards that contribute to each SDG according to ISO and the last column shows the most representative standard for achieving the SDG. It is worth mentioning that, each standard contributes to more than one SDG, for example, ISO 20400 Sustainable Procurement contributes to SDGs 1, 2, 5, 8, 10, 11, 12, 16, 13; ISO 26000 supports to achieve the following SDGs 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, and so each standard can contribute to more than one SDG.

Industrial Maintenance and SDGs

This is how the 17 SDGs for sustainable development can be linked in any organisation. Any of the SDGs we look at is related to these three dimensions.

For industrial maintenance it is paramount to be aware that its interventions in company processes and systems positively or negatively affect the achievement of the SDGs, so let's look at some SDGs and industrial maintenance.

SDG 6 Clean water and sanitation involves measures of access to adequate and equitable sanitation and hygiene services; water recycling and reuse systems; efficient use of water. The area of maintenance is directly and indirectly concerned with this non-renewable resource in its facilities and optimal management. ISO 24518 establishes guidelines for sustainable water management in organisations.

ISSN: 2523-0344
RENIECYT-CONAHCYT: 1702902

SDG 7 Affordable and clean energy, which includes the use of renewable and clean energy; improvement of energy efficiency and modernisation of energy management through the analysis of energy consumption, more efficient lighting systems, smart equipment, among others. The ISO 55000 family is an energy management system that promotes energy sustainability and efficiency by optimising resources and costs; ISO 50001 is certifiable.

SDG 8 Decent work and economic growth promotes full and productive employment, decent work for all and sustainable and inclusive economic growth. The area of maintenance contributes to the optimisation of the resources it uses in its activities such as human resources and cost reduction for sustainable economic growth. ISO 45000 describes the requirements for an occupational health and safety management system to reduce occupational risks, reduce accidents and occupational diseases.

SDG 9 Industry, Innovation and Infrastructure with reliable, smart, sustainable, accessible and quality structures; optimisation of resources; industrial diversification and innovation; universal access to information and communication technologies. Maintenance intervention is with IIoT; predictive maintenance 4.0; interoperability between systems and platforms; machine learning for maintenance data analytics for an effective and efficient decision-making process, for example. The ISO 55000 family refers to an asset management system in companies establishing the optimisation of processes, allocation of resources and increasing the lifetime of assets.

SDG 12 Responsible Consumption and Production through sustainable management and efficient use of natural resources; reduction, recycling and reuse strategies; sustainable practices, maintenance intervenes through energy efficiency; responsible waste management; resource conservation; alignment of industrial maintenance with sustainable development. ISO 14020 sets out requirements for the use of environmental labels and declarations, as well as ISO 15392 describes general principles for sustainability in buildings and civil engineering works.

SDG 13 Climate action manages urgent measures to combat climate change and its impacts. For maintenance, the life cycle of an asset includes design, construction, installation, operation, refurbishment and recycling. This life-cycle cost analysis of an asset enables it to contribute to achieving sustainable development in its three dimensions: social, economic and environmental. One of the standards that facilitate this is ISO 14000, an environmental management system to reduce the environmental impact generated by companies and also the social impact and, therefore, the economic impact through its principles focused on the environment.

Results

The latest assessment of the SDGs by the United Nations describes the progress achieved by the custodian bodies and paints an alarming picture. Of the 140 targets that can be assessed, 50 per cent exhibit moderate or severe deviations from the desired path, while more than 30 per cent show no discernible progress or worse still show a regression below the 2015 baseline.

This measurement of the SDGs indicates the pressing need to intensify efforts to ensure that the SDGs remain on trend or that the necessary changes are made to move towards a sustainable future. Figure 3 shows that SDG 12 has 37% achievement of its targets, SDG 1 has 71% progress, SDG 14 has the highest stagnation at 60%, SDG 7 has only 21% stagnation and 79% combined achievement and progress of its targets, SDG 11 has 59% insufficient data for assessment.

The UN 2023 report concludes that 15% of the SDGs are on track, 48% are seriously or moderately behind and 37% are stagnating or regressing.

ISSN: 2523-0344
RENIECYT-CONAHCYT: 1702902

Herrera-Sánchez, Gustavo, Morán-Bravo, Luz del Carmen, Silva-Juárez, Alejandro and De Sampedro-Poblano, Héctor Manuel. [2024]. Sustainable development goals and ISO standards in industrial maintenance. Journal Industrial Engineering. 8[20]-1-9: e30820109. DOI:https://doi.org/10.35429/JIE.2024.8.20.3.9

Box 5

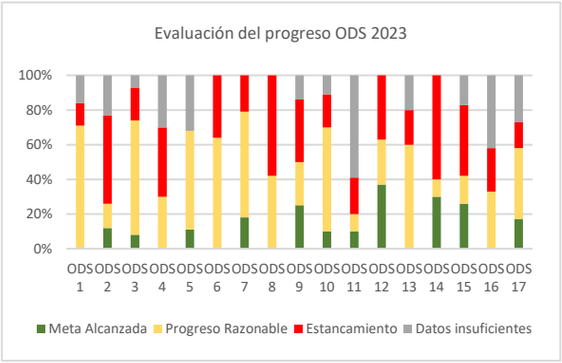


Figure 3
Assessment of SDG 2023 progress

Source: United Nations 2023

From a standardisation point of view, the number of ISO certificates is an indication of the formal commitment of companies to the achievement of the SDGs in all three aspects of sustainable development. The number of valid certificates issued until 2022 are shown in table 3 below.

Box 6

Table 3
Number of ISO 2022 recognised certificates

Standard ISO	2022	2021	2020	2019
ISO 9001	1,265,216	1,077,884	916,842	883,521
ISO 14001	528,903	420,433	348,218	312,580
ISO 45001	397,339	294,420	190,429	38,654
ISO IEC 27001	71,549	58,687	44,486	36,362
ISO 22000	45,459	36,124	33,735	33,502
ISO 13485	29,543	27,229	25,656	23,045
ISO 50001	27,631	21,907	19,721	18,227
ISO 20000-1	27,009	11,769	7,846	0
ISO 37001	5,901	2,896	2,065	872
ISO 39001	1,550	1,285	936	864
ISO 55001	997	0	0	0
ISO 28000	521	584	520	1,874
ISO 20121	247	0	0	0
ISO 29001	177	0	0	0
ISO 44001	118	0	0	0

Source: The Survey ISO 2023.

Table 3 shows that the overall number of certificates has a positive trend, with an increase of 23% from 2021 to 2022. ISO 9001 is still the most requested standard and its increase is 17% from 2021 to 2022.

In general, standards 14001 (26%), 45001 (35%), 22000 (26%), 50001 (26%), 37001 (104%), 55001 and 44001 show increases in their certifications and this generates systematic, regular and robust systems and processes to comply with the requested requirements and contribute to sustainable development.

There are other ISO standards focused on industrial maintenance, apart from ISO 55001 Asset management, there is ISO 14224 Collection and presentation of equipment reliability and maintenance data, the ISO 13381 family System diagnosis and condition, ISO 13374 Condition monitoring and diagnosis of machines.

For maintenance management, there are also other standards, e.g. ANSI TAPPI TIP 0305-34:2008 refers to a maintenance protocol for management by creating daily, weekly and monthly maintenance checklists. The MIMOSA organisation develops open information standards related to the exchange and integration of data in operation and maintenance systems.

Discussion

According to the presented results of the SDGs and number of ISO certificates with respect to contributing standards, the gap to achieve the UN 2030 Agenda is large due to the number of factors involved, it is necessary to strengthen the established actions to make them more efficient and effective.

As far as industrial maintenance is concerned, ISO 55001 is in an incipient state to be used and the other non-certifiable standards are up to the organisations to implement.

For example, green maintenance focuses on reducing the environmental impact of its activities by involving the use of sustainable practices and green technology for the reduction of electrical energy consumption, minimising waste and reducing the use of hazardous materials. This involves sustainable best practices such as reducing the carbon footprint, reducing dependence on non-renewable resources, improving the health and well-being of workers, reducing operating costs, reducing the risk of environmental pollution, among others, with the main focus on contributing to the long-term sustainability of all their assets.

ISSN: 2523-0344
RENIECYT-CONAHCYT: 1702902

Herrera-Sánchez, Gustavo, Morán-Bravo, Luz del Carmen, Silva-Juárez, Alejandro and De Sampedro-Poblano, Héctor Manuel. [2024]. Sustainable development goals and ISO standards in industrial maintenance. Journal Industrial Engineering. 8[20]-1-9: e30820109. DOI:https://doi.org/10.35429/JIE.2024.8.20.3.9

Certainly, companies are applying this green maintenance approach in Canada, making maintenance activities more supportive of being environmentally sustainable in the long term.

From another perspective, sustainable industrial maintenance performs maintenance activities efficiently and sustainably, employing processes to minimise the consumption of energy, water and other non-renewable natural resources, as well as reducing the generation of waste and pollutant emissions and promoting reuse and recycling.

Finally, ISO 9001 as the flagship ISO standard supports the following SDGs: 3 Health and well-being, 8 Decent work and economic growth, 9 Industry, innovation and infrastructure, 10 Reducing inequalities, 11 Sustainable cities and communities, 12 Responsible production and consumption and 13 Climate action. There is also an agreement between ISO and the United Nations Development Programme (UNDP) for the development of an international standard, ISO/WD 53001.2 Management systems for the United Nations Sustainable Development Goals - Requirements for demonstrating and improving performance towards the SDGs in a systematic and accountable manner.

Conclusions

We are in the transition from Industry 4.0 to Industry 5.0, where the latter has the human being at the centre, resilience and sustainability as its pillars, then, maintenance 5.0 seeks the optimisation and upgrading of maintenance operations through new technologies that are friendly to sustainable development. Focusing on sustainability, Industry 4.0 seeks to optimise resources such as electrical energy consumption through 4.0 technologies, whereas Industry 5.0 focuses on the use of renewable energy sources and efficient energy systems for the reduction of carbon footprint and the success of sustainable development.

Therefore, companies should prioritise their activities for sustainable development success with sustainable overall objectives, sustainable policies, sustainable plans, sustainable strategies, sustainable procedures, sustainable budgets and sustainable programmes. This approach should permeate all their operational areas.

Industrial maintenance must be aligned to this sustainable philosophy through disruptive and sustainable technologies, sustainable predictive maintenance, sustainable preventive maintenance and development of all its processes to address the social, economic and environmental dimensions to achieve the 2030 Agenda and sustainable development.

Declarations

Conflict of interest

The authors declare that they have no conflicts of interest. They have no known competing financial interests or personal relationships that might have appeared to influence the article reported in this paper.

Authors' contribution

Herrera-Sánchez, Gustavo. I contributed to the conception of the project and the development of the research.

Morán-Bravo, Luz del Carmen. I contributed to the development of the research, analysis and interpretation of the data.

Silva Juárez, Alejandro. I contribute to the methodological review of the research.

De Sampedro Poblano, Héctor Manuel. I contributed with layout, proofreading and editing.

Availability of data and materials

Data used and analysed during this research can be requested from the corresponding author.

Funding

This research was funded by the Universidad Tecnológica de Puebla.

Acknowledgements

The Technological University of Puebla has supported the development of this analysis with the participation of the following Divisions of Industrial Maintenance, Business and Information Technologies.

ISSN: 2523-0344
RENIECYT-CONAHCYT: 1702902

Herrera-Sánchez, Gustavo, Morán-Bravo, Luz del Carmen, Silva-Juárez, Alejandro and De Sampedro-Poblano, Héctor Manuel. [2024]. Sustainable development goals and ISO standards in industrial maintenance. Journal Industrial Engineering. 8[20]-1-9: e30820109. DOI:https://doi.org/10.35429/JIE.2024.8.20.3.9

Abbreviations

AENOR	Spanish Association for Standardisation and Certification
ANCE	Association for Standardisation and Certification
ANSI	American National Standards Institute
BSI	British Standards Institution
BIPM	International Bureau of Weights and Measures
DGN	Directorate General for Standards
DIN	German Standards Institute
IEC	International Electrotechnical Commission
IIoT	Industrial Internet of Things
INNTEX	National Institute for Textile Standardisation
IMNC	Mexican Institute for Standardisation and Certification
ISO	International Organization for Standardization
ITU	International Telecommunication Union
JIS	Japanese Industrial Standards
NMX	Voluntary Mexican Standards
NOM	Mexican Official Standard
OILM	International Organisation of Legal Metrology
ODS	Sustainable Development Goals
ONU	United Nations
PNUD	United Nations Development Programme

References

Background

Aguilera, C. Casares, R., García, A. (2022). Mantenimiento 5.0, tendencias y desafíos. Conferencia: XI Congreso Cubano de Ingeniería Mecánica y Metalurgía (CCIM 2022), págs. 1-8. Hábana.

Aisoncore. (February 20, 2024). Mantenimiento Minero. Qué significa un Mantenimiento inteligente 4.0:

Cárdenas, A. (10 de abril de 2024). Secmotics Smart inside. Obtenido de Mantenimiento Industrial Sostenible: qué es y sus beneficios.

Coraza, E. (6 de noviembre de 2018). ISO 9004:2018-4 Gestión para el éxito sostenido de una organización.

Damián, C. A., Hernández, A., Esteban, G. J., & Bellon, D. (2022). Desde la sostenibilidad hasta el desarrollo sustentable: Una radiografía de la evolución del concepto. *LATAM Revista Latinoamericana de Ciencias Sociales y Humanidades, 3(2)*, 1536-1550.

Herrera, G. (Agosto de 2023). La normalización en tu vida profesional. *Semana de Negocios: Impulsando la Innovación y el Espíritu Emprendedor. División de Negocios*. Puebla, México: Universidad Tecnológica de Puebla.

Holgado, M., Macchi, M., & Evans, S. (2020). Exploring the impacts and contributions of maintenance function for sustainable manufacturing. *International Journal of Production Researech, 58*(15), 1-19.

Instituto Mexicano de Normalización y Certificación, A.C. (2023). Reunión de trabajo Noviembre 2023 CTNN 9. Ciudad de México.

ISO and the Sustainable Development Goals. (10 de Julio de 2024). *ISO and the Sustainable Development Goals*.

ISO/WD 53001. (17 de julio de 2024). ISO/WD 53001.2 *Management Systems for UN Sustainable development goals – Requirements*.

Ji, S., & Ma, S. (2022). The effects of industrial pollution on ecosystem service value: a case study in a heavy industrial area, China. *Environ Dev Sustain 24*, 6804-6833.

MaintWiz. (15 de julio de 2024). *The Importance of Green Maintenance*.

MIMOSA. (julio de 15 de 2024). *MIMOSA Open Standards for Phisical Asset Management*.

Naciones Unidas La Agenda 2030. (2018). *La Agenda 2030 y los Objetivos de Desarrollo Sostenible: una oportunidad para América Latina y el Caribe*. Santiago: Naciones Unidas (LC/G.2681-P/Rev.3).

Naciones Unidas ODS. (4 de julio de 2024). *Objetivos de Desarrollo Sostenible*.

Qualitymant. (febrero de 2023). *El papel del mantenimiento industrial en el desarrollo de una industria sostenible*.

ISSN: 2523-0344
RENIECYT-CONAHCYT: 1702902

Herrera-Sánchez, Gustavo, Morán-Bravo, Luz del Carmen, Silva-Juárez, Alejandro and De Sampedro-Poblano, Héctor Manuel. [2024]. Sustainable development goals and ISO standards in industrial maintenance. Journal Industrial Engineering. 8[20]-1-9: e30820109. DOI:https://doi.org/10.35429/JIE.2024.8.20.3.9

Secretaria de Economía. (10 de julio de 2024). *DIRECTORIO DE ORGANISMOS NACIONALES DE NORMALIZACIÓN (ONN)*.

Singh, A., Rahman, Z., & Olan, F. (3 de noviembre de 2021). Integrating corporate sustainability and sustainable development goals: towards a multi-stakeholder framework. *Cogent Business & Management, 8(1)*, 1-19.

Smale, A. (4 de Julio de 2024). Organización de las Naciones Unidas. Obtenido de Crónicas ONU. Qué implican los ODS.

Zarta, P. (2018). LA SUSTENTABILIDAD O SOSTENIBILIDAD: UN CONCEPTO PODEROSO PARA LA HUMANIDAD. *Tabula Rasa, núm. 28*, 409-423. Obtenido de

Basics

Hernández, R., Fernández, C., Baptista, M. (2014). Metodología de la Investigación. (Sexta Edición). México: McGraw Hill.

Support

Arocha, A. (24 de julio de 2020). 5 Normas imprescindibles para una gestión eficaz del mantenimiento industrial.

Naciones Unidas Informe ODS 2023. (11 de julio de 2024). *Informe de los Objetivos de Desarrollo Sostenible 2023*.

The ISO Survey. (11 de julio de 2024). *The ISO Survey*.

Discussion

Click Maint. (15 de julio de 2024). Green Maintenance.

Cywiski, M. (1 de octubre 2023). Greening maintenance operations. *MRO Canada´s Maintenance Voice*.

ISSN: 2523-0344
RENIECYT-CONAHCYT: 1702902

Herrera-Sánchez, Gustavo, Morán-Bravo, Luz del Carmen, Silva-Juárez, Alejandro and De Sampedro-Poblano, Héctor Manuel. [2024]. Sustainable development goals and ISO standards in industrial maintenance. Journal Industrial Engineering. 8[20]-1-9: e30820109. DOI:https://doi.org/10.35429/JIE.2024.8.20.3.9