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Gap analysis for standardization on sustainable and human-centred societies enabled with cyber physical systems

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

International Workshop Agreement IWA 39 was approved at a series of workshops hosted by the Japanese Industrial Standards Committee (JISC), in association with Japanese Standards Association (JSA), held virtually in February 2021, May 2021, September 2021 and February 2022.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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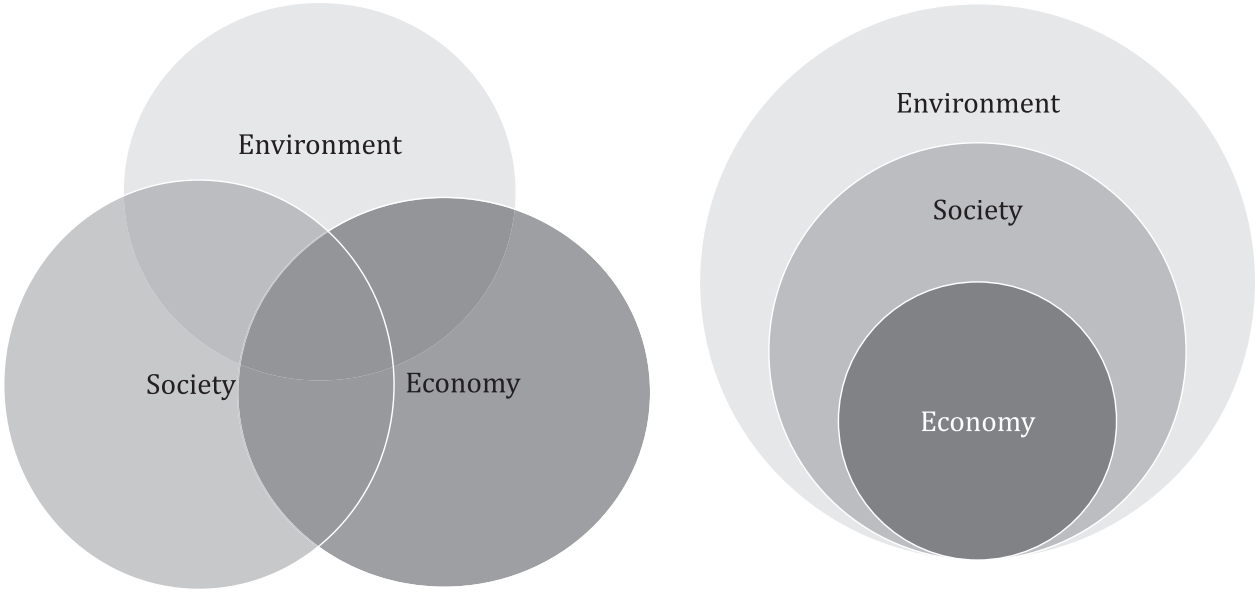
Introduction

The seventeen UN Sustainable Development Goals (SDGs) provide a shared blueprint for peace and prosperity for people and the planet, now and into the future. ISO, IEC and other standards development organizations (SDOs) are making efforts to contribute to SDGs through the development of international standards and deliverables.

Sustainability is important for many reasons including environmental quality; to have healthy communities, clean air, natural resources, and a nontoxic environment. Sustainability is most often defined as meeting the needs of the present without compromising the ability of future generations to meet theirs. It has three main pillars: Economic, Environmental, and Social. These three pillars as shown in Figure 1 are informally referred to as people, planet and profit. However, it refers to four distinct areas: Human, Social, Economic and Environmental.



Three overlapping circles model Triple nested dependency model

Figure 1 — The triple nested dependency model of sustainability

In this triple nested dependency model, the three sectors are co-dependent and it is recognized that the economy is a wholly owned subsidiary of the society which in turn is a wholly owned subsidiary of the environment. They not only co-exist but interact. Rather than the three sectors competing, this model reminds us that without clean water, fresh air and healthy ecosystems the society and the economy cease to function.

The importance of environmental issues (e.g., climate action) is widely recognized around the world, and many international standardization and international initiatives are trying to resolve these issues. This, however, does not expand quickly since it requires fundamental behavioural changes which are difficult to scale beyond individuals, and across organizations and nations. One of the major reasons for this difficulty is that some of the actions for achieving sustainability goals have conflicts with each other, which are called issue linkages, typically between human-centred aspects and environmental sustainability aspects which need to be resolved and harmonized.

Human needs are a powerful explanation of human behaviour and social interaction. All individuals have needs that they strive to satisfy.

Technologies such as Cyber-Physical Systems (CPS) and Internet of Things (IoT) have the potential to help create a society in which people enjoy their lives without feeling any restrictions, while contributing to the improvement of social, environmental and economic sustainability.

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However, there is a concern that CPS can have adverse effects, which is an issue to be considered when a CPS is introduced into society.

Issues related to human-centred aspects and other sustainability aspects have been discussed in documents developed by ISO/TC 207, *Environmental management,* in International Standards such as ISO 26000, and in initiatives led by international organizations such as the World Business Council for Sustainable Development (WBCSD) and the World Economic Forum (WEF). However, there is no current area of standardization which addresses a holistic view of this landscape and how to resolve those issues enabled by CPS, which also consider any adverse impacts.

Humans need to radically change our relationship, not just with the planet, but with the objects with which we fill our lives to advance the progress we can make towards sustainability. We need to change how we think about technology and innovation. Rather than allowing technological advancement to steer our narratives, innovation and technology should help us build bridges between the worlds we inhabit now and the ones we imagine for tomorrow.

This document was developed at a series of workshops whose participants conducted a gap analysis between the existing areas of standardization and the goal of achieving human-centred sustainability.

This document is the result of an open and transparent multi-stakeholder process involving experts from different countries representing a variety of different perspectives. It is a voluntary guidance document intended for global use.

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Gap analysis for standardization on sustainable and human-centred societies enabled with cyber physical systems

1 Scope

This document provides a gap analysis between existing areas of standardization and the needs of human-centred sustainable societies enabled by cyber physical systems. This document does not cover the technical requirements of cyber physical systems.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
cyber physical system
CPS
system with digital, analogue, cyber, physical and human components interacting with each other, engineered to function through integrated physics and logic

3.2
system of systems
SoS
set of operationally and managerially independent systems that coordinate their work together to achieve one or more common stated purposes

Note 1 to entry: Each constituent is a useful system by itself, having its own management, goals, and resources, and coordinates within the SoS to provide the unique capability of the SoS.

[SOURCE: IEC Electropedia, IEV 871-05-03, modified — The words “are operated together for a period of time” have been replaced by “coordinate their work together” and the word “common” has been added in the definition; the original Note 1 to entry has been replaced by a new Note 1 to entry adapted from ISO/IEC/IEEE 24748-1:2018, 3.56.]

3.3
issue linkage
conflict between some of the actions for achieving different sustainability goals

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3.4
human-centred sustainable society
society that is highly sustainable supporting human well-being and dignity

Note 1 to entry: In this document, the state of a human-centred sustainable society is referred to as "human-centred sustainability". Sustainability in a broader sense can include a part of human-centred aspects, however, it does not cover all of them, and includes *issue linkages* (3.3) between human-centred aspects and others. For this reason, the term "human-centred sustainability" is used in this document.

4 Overview

4.1 General

The society envisioned in this document is a human-centred sustainable society contributing to UN SDGs and other relevant issues. This document focuses specifically on how human-centred sustainability and other sustainability (e.g. environmental sustainability) is enabled or impacted by CPS (both beneficially and adversely), and on how the issue linkages between SDGs and other relevant issues can be resolved and harmonized by CPS.

Interactions between a physical (or real) space and cyberspace, beneficial or adverse, are intrinsic properties of CPS. On the contrary, feedback from the real space to CPS in terms of human-centred and other sustainability aspects are investigated in this document. If the CPS has a beneficial impact, the feedback should be positive to enhance the impact even more, but if the impact is adverse, the feedback should be negative to suppress the impact (see Figure 2).

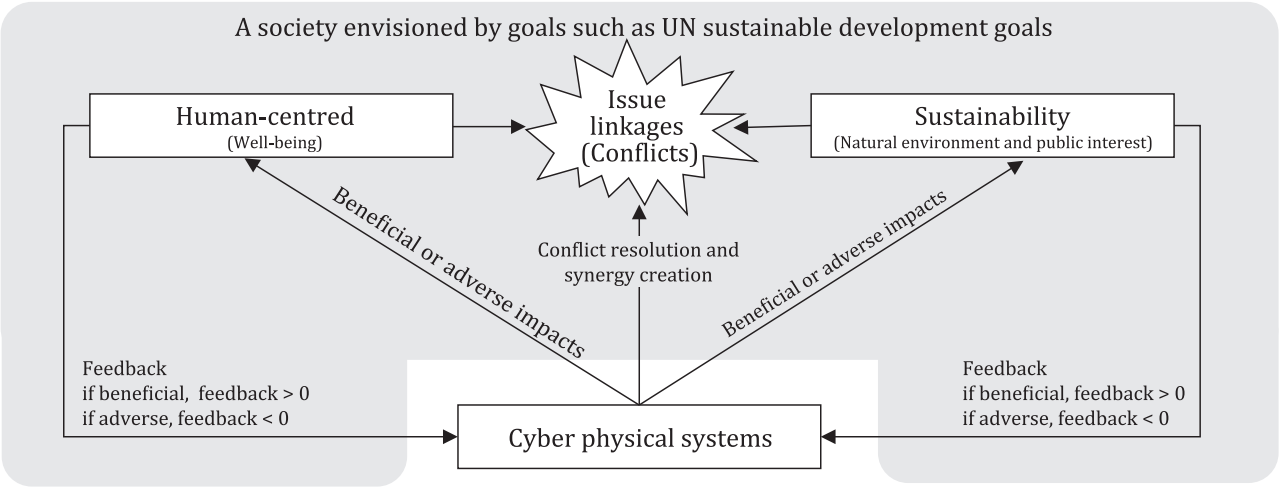

Figure 2 — Perspectives of the gap analysis

This document outlines issues and practices and provides lists of related standards, based on the following four perspectives:

— how human-centred aspects are impacted by CPS (see Clause 5);

— how sustainability (environment and society) is impacted by CPS (see Clause 6);

— what the issue linkages are and how CPS can help (see Clause 7);

— how CPS can be implemented to resolve the identified issues (see Clause 8).

Table 1 list issues and practices related to human-centred sustainability together with their relevance to SDGs, indicating beneficial impacts or adverse impacts. Referenceable documents for subjects of each perspective are listed in the subsequent tables, indicating the relevant SDGs and type of standards defined in 4.3.

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