ZDZW

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NON-DESTRUCTIVE INSPECTION SERVICES FOR DIGITALLY ENHANCED ZERO WASTE MANUFACTURING

D3.10
STANDARDIZATION PLAN AND STATUS REPORT

V1.0

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ABBREVIATIONS / ACRONYMS

ACRONYM	MEANING
AA	Working Group (Ger: Arbeitsausschuss)
AG	Advisory Group
AI	Artificial Intelligence
AM	Additive Manufacturing
ASTM	American Society for Testing and Materials
CCMC	CEN/CENELEC Management Centre
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
CWA	CEN Workshop Agreement
D	Deliverable
DIN	German Institute for Standardization (Deutsches Institut für Normung e. V.)
DIN SPEC	German document description for a workshop agreement
DKE	Deutsche Kommission Elektrotechnik Elektronik Informationstechnik
DT	Digital Twin
EFTA	European Free Trade Association
EN	European Standard
ETSI	European Telecommunications Standards Institute
EU	European Union
GA	Grant Agreement
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization
ITU	International Telecommunication Union
JWG	Joint Working Group
NDI	Non-destructive Inspection
NSB	National Standards Body
NWIP	New Work Item Proposal
SDO	Standards Development Organization
TC	Technical Committee
TS	Technical Specification
WG	Working Group
WP	Work Package
ZD	Zero-defect
ZDM	Zero-defect Manufacturing
ZDMP	Zero-defect Manufacturing Platform (https://www.zdmp.eu/)
ZDZW	Zero-defect zero-waste
ZW	Zero-waste

EXECUTIVE SUMMARY

This deliverable describes the work performed within T3.6 Standardization within the EU-funded research project non-destructive inspection services for digitally enhanced zero waste manufacturing (ZDZW).

The main objective of Standardization within ZDZW is to promote project results and transfer generated project knowledge into project-related standardization activities. A further objective is that interoperability of ZDZW is fostered by the usage of existing standards.

D3.10 gives an overview about standardization and presents possibilities how to interact and contribute to standardization in general. It shows the standardization landscape for zero-defect manufacturing and where zero-waste manufacturing shall be located in this context. Furthermore, this document presents the recent efforts towards zero-defect-manufacturing standardization and an outlook about the envisaged CEN Workshop on ZDM Basic Principles and Requirements is given.

1 INTRODUCTION

The D3.10 titled "standardization plan and status report" describes the existing standards and standardization activities and has the objective to provide an overview about existing standards and standardization activities to the project partners. It also shows a roadmap for the standardization activities which will be conducted by ZDZW.

One of the main methods of ZDZW to achieve, for example, the reduction of waste in the manufacturing process of goods is zero-defect manufacturing (ZDM). Currently, there is no standardization basis that describes what exactly ZDM is and how ZDM can be applied in manufacturing companies. In addition, there is no possibility for manufacturing companies to verify that they are successfully applying ZDM.

There are preliminary activities from the European research project Zero-Defect Manufacturing Platform (ZDMP) (Grant agreement ID: 825631) on which the standardization activities within ZDZW can build.

So far, there exists a CWA (CEN Workshop agreement) at the European level, which defines the terminology of the terms used within ZDM (see CWA 17918:2022) and an IEC/TR (technical report) about emerging technologies at the international level. These documents can be understood as pre-standards. In this regard, the focus of the European research project ZDZW is on the continuation and successful implementation of the standardization activities based on the previous work within ZDMP.

The foreseen activities also include determining how to successfully place the planned CWAs within the standardization landscape relevant to ZDM.

Standardization documents on ZDM would facilitate knowledge and technology transfer and would be a good argument to use the methods and tools developed within the European research project ZDZW commercially and widely in manufacturing companies. This would further drive waste reduction and efficiency improvement in the industrial sector.

1.1 Relation to other ZDZW activities and deliverables

This is the first deliverable of a series to be updated at M24 and M36. Standardization is closely related to dissemination activities, as it informs the standardization community which is composed of experts in the respective fields about standardization activities in ZDZW. Standardization also helps to exploit the results of ZDZW.

1.2 Structure

This deliverable is structured as follows. Firstly, chapter 2 provides a brief introduction about the standardization system and how standardization in general works. The following part (chapter 3) provides basic information about the current status of the standardization landscape as well as the identified committees being potentially relevant for the ZDZW project. Chapter 4 describes the motivation and the upcoming steps for the planned CEN Workshop regarding ZDM Basic Principles and Requirements. In chapter 5 a brief overview about the Standardization Workshop can be found, which was intended

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to familiarize the project partners with the CEN Workshop and create a common basis on ZDM. The key results and findings of the Survey on standardization within ZDZW can be found in chapter 6.

2 STANDARDIZATION BASICS

2.1 General

Within ZDZW a pre-standard, called CEN Workshop Agreement will be elaborated. Therefore, it is important to clarify the characteristics of a standard. In general, a standard is a consensus-based document that is approved by a recognized body or organization, reflecting the state of the art. It should be based on the consolidated results of science, technology, and experience, and aim to promote optimal community benefits.[1]

Standardization is used to agree on terminologies, methodologies, requirements, characteristics, etc. in specific areas to make a product, process, or service fit for its purpose. Thus, standardization can drive innovative outcomes by agreeing on common product requirements such as interoperability, quality or safety, and provide guidelines for achieving them. Standardization supports the development of a generic language, which is understandable for everyone and thus helps to create a common basis. The result of the standardization process is a document, which provides rules, guidelines or characteristics for activities or their results.

2.2 Standard developing organisations

An essential aspect of standardization is to ensure that standardization documents do not contradict each other, especially since European and international standardization have gained significant importance.This is reflected in DIN's statistics, which show that European and international standards account for 90% of all standardization projects nowadays. The following clauses give a brief description of the framework of formal standardization on international, European, and national level. Figure 1 provides a general overview of the different types and levels of standardization.

2.2.1 National standardization

On national level, there are different structures and standardization bodies in different countries, as e. g. German Institute for Standardization (DIN), German Commission for Electrotechnical, Electronic, and Information Technologies (DKE), Spanish Standardization Body (UNE), the French Standardization Association (AFNOR) and the British Standards Institute (BSI In general, each country has one or more recognized national standardization bodies (NSB). Within the NSB's experts from different stakeholders, e.g., from organizations belonging to industry, commerce, the public sector, or research, are developing national standards. These NSB's are also responsible for keeping the national standardization repository updated.

[1] CEN/CENELEC, „EN 45020:2006: Standardization and related activities - General vocabulary "2006

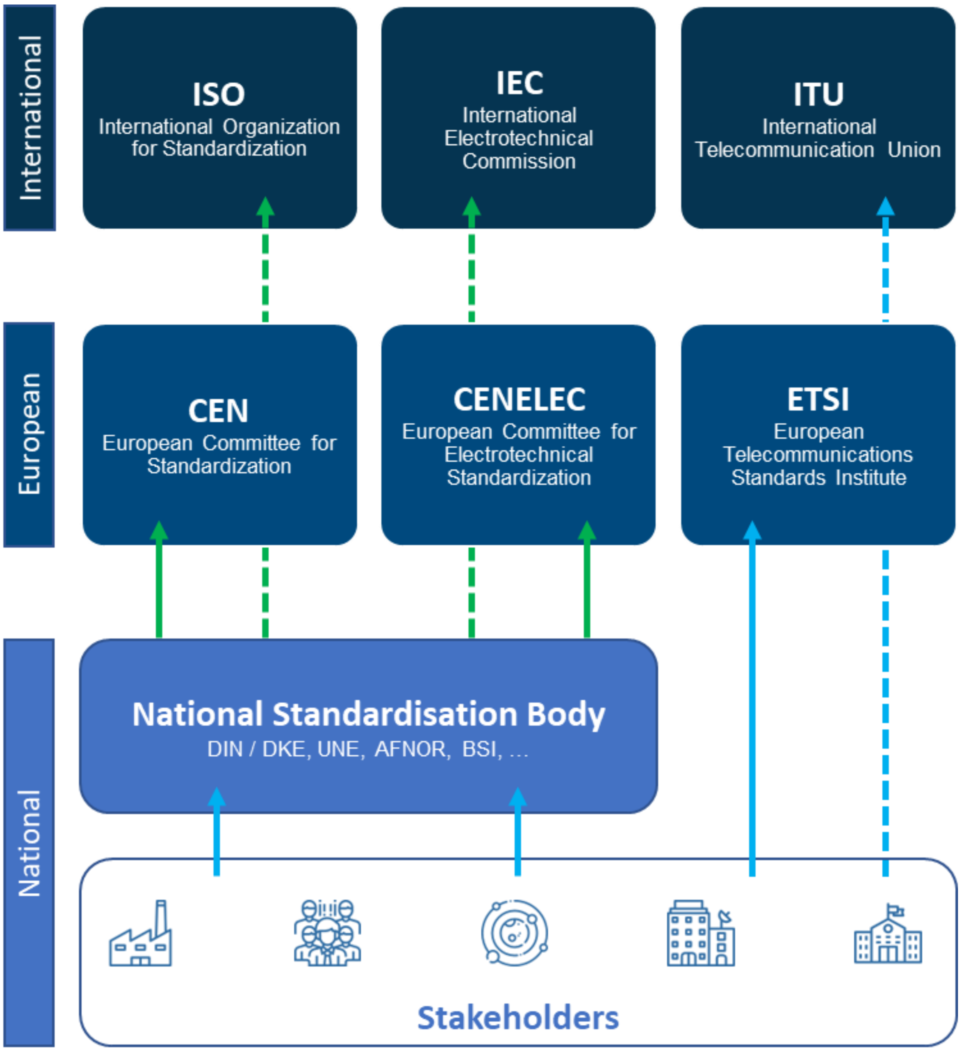

FIGURE 1: OVERVIEW OF THE ORGANIZATIONAL STRUCTURE OF THE STANDARDIZATION WORLD (AFTER [HARTLIEB2009])

To represent national positions at European or international level, so-called mirror-committees are set up and coordinated by the NSB's. In these national committees, the work and existing results of corresponding European and international standardization committees are discussed, a national opinion is developed, and the final drafts of standards are agreed upon. When European or international draft standards are published for comment, the mirror committees also vote on whether the standard should be published or not.

Here it is important to mention, that experts working on European or international level need to be members of the national mirror committee and must be delegated by these committees.

2.2.2 European standardization

The main goal of European standardization is the development of European standards, which are valid and accepted within the EU. These European standards are the basis for the European single market. The European standardization organisations CEN[2] (European Committee for Standardization), CENELEC[3] (European Committee for Electrotechnical Standardization), and ETSI[4] (European Telecommunications Standards Institute) are responsible for the organisation of European standardization work. CEN is responsible for all non-electronic activities and CENELEC for electrotechnical standardization activities, while ETSI is responsible for the standardization activities in the field of telecommunication at European level.

There is a particularly close cooperation between CEN and CENELEC, which are made up of national standardization organisations from the EU and EFTA (European Free Trade Association) member states, as well as states seeking membership. In contrast, the members of ETSI are directly European companies, institutes, and organizations.

The so-called delegation principle applies to CEN and CENELEC. This means, that the mirror committees of the national standardization bodies of their member states, send national experts to the technical committees and workings groups at CEN or CENELEC to develop European standards. The European standard (EN) will only be published, when a sufficiently large majority of the national standardization organisations has approved the final draft.

EN standards must automatically be adopted by member states of the EU and opposing national standards must be withdrawn. As a result of this mandatory adoption, the EN standards in Germany then become DIN EN standards (e.g., DIN EN 16575). There are situations in which it is possible to complement EN standards with additional national standards, for instance to set more detailed requirements to meet specific needs of the member state.

European specifications are referred to as CWA as well as CEN TS or CENELEC TS, depending on the type of development and their adoption by the member states is voluntary (e.g., DIN CEN/TS 17045), unlike the adoption of European standards.

2.2.3 International standardization

The international standardization organisations ISO[5] (International Organization for Standardization), IEC[6] (International Electrotechnical Commission), and ITU[7] (International Telecommunication Union) are responsible for the organisation of international standardization work. ISO is responsible for all non-electronic and IEC for

[2] www.cen.eu
[3] www.cenelec.eu
[4] www.etsi.org
[5] www.iso.org
[6] https://www.iec.ch/
[7] https://www.itu.int

electrotechnical standardization activities, while the ITU is in charge of standardization activities in the field of telecommunications.

ISO and IEC are made up of the national standardization organisations, with e.g., DIN and DKE representing German interests on an international level. The ITU, on the other hand, is a special unit of the United Nations, whose 191 member states develop recommendations together with companies from the private sector and other regional and national organisations. Only when they are adopted by normative organizations such as ISO, ANSI (USA) or ETSI as well as by national regulatory authorities, such as the Federal Network Agency in Germany, they acquire the character of standards.

The so-called delegation principle also applies to ISO and IEC, meaning that the national standardization organisations send their experts to the working groups and technical committees of the international standardization bodies. An international standard (ISO) is only accepted, when a sufficiently large majority of the national standardization organisations has voted for its draft. International specifications are called IWA as well as ISO TS or IEC TS, depending on the type of development.

In contrast to European standardization, there is no obligation to adopt international standards in national standards. However, since internationally applicable standards are relevant for international trade or for global stakeholders, conflicting national or European standards should be avoided. There is the possibility of transferring international standards in European and national standards. The resulting documents have the characteristics and names listed in Table 1: Names of international standards depending on their adoption level, depending on the background. There are also parallel processes for developing standards at international and European level. It is possible to directly develop EN ISO or EN IEC standards without first developing the standard on international level and then adopting it at European level.

TABLE 1: NAMES OF INTERNATIONAL STANDARDS DEPENDING ON THEIR ADOPTION LEVEL

NAME	DESCRIPTION
ISO XXXXX	International standard adopted on neither national nor European level
DIN ISO XXXXX	International standard adopted only on national (Germany) level
DIN EN ISO XXXXX	International standard adopted on European and national level

2.3 Standardization documents

2.3.1 General

There are several types of standardization documents that differ in their development process, the degree of consensus to be reached, and the openness to participation Figure 2: Types of standardization documents. Standardization documents describe products, systems or services by defining their characteristics and requirements and in many cases are publicly available.

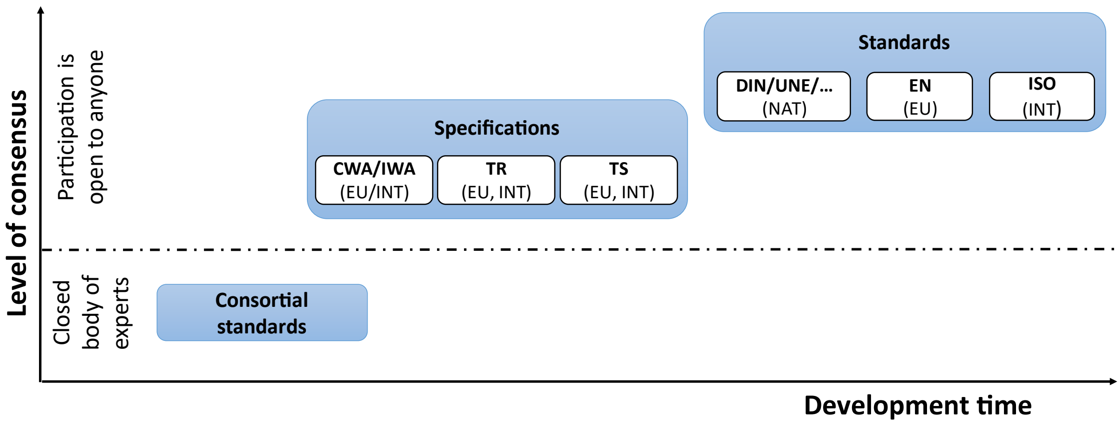

FIGURE 2: TYPES OF STANDARDIZATION DOCUMENTS

2.3.2 Standard

According to Figure 2, standards in the narrower sense are developed within the formal standardization system where all interested parties have to be included in the development process of the document and consensus, meaning the general agreement of all participants and the lack of sustained objection to central content, must be reached. The main objective of the consensus is to take into account the views of all interested parties concerned and to dispel any counter-arguments. The development of a European standard is shown in Figure 3.

FIGURE 3: DEVELOPMENT OF A STANDARD, AFTER [DININFO]

First of all, anyone who has identified a need for a standard can submit a proposal for a new standard. In most cases this has to be done via the national mirror committee. The associated standards committee evaluates the need and whether standardization activities are already taking place or if standards that cover the described need exist. If the need is confirmed, a standard is then developed in a standardization committee. Attention is paid to a balanced composition of these committees with all interested parties concerned (science, consumers, industry, ...) in order to guarantee the neutrality of the documents. A final draft, approved by the standards committee, is then released for public comment. All comments have to be discussed before the final standard is approved by the standardization committee. Due to the high level of transparency and the involvement of the public, the development time increases from national to European and international level. National standards usually require 18 months to develop, while the development of European and international standards normally takes more than two years due to the involvement of the national standardization bodies.[8] Due to the high degree of consensus, standards have a high level of acceptance in society.

2.3.3 Consortial standards

Regarding the development time, the fastest ones are consortial standards (see Figure 4: Development of a pre-standard), also called industry, informal or de-facto standards. Among other things, they are characterised by the fact that not all interested parties need to be included in the development process. These closed group of experts can be, e. g. industry-specific consortia that have been formed from different companies. Although these documents have some characteristics of a standardization document, such as defined procedures or documentation rules, consortial standards are often not freely accessible and are developed in private.

[8] https://www.iso.org/developing-standards.html

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2.4 Pre-standards

Pre-standards are public, freely available documents which describe products, systems, or services by defining characteristics and requirements. The pre-standard is characterized by the fact that, compared to a standard, a consensus is not necessary, and the involvement of all interested parties is not obligatory. Their development is shown using the example of a CWA in Figure 4: Development of a pre-standard.

FIGURE 4: DEVELOPMENT OF A PRE-STANDARD, AFTER [DINInfo]

Anyone can apply to develop a pre-standard. A standardization organization checks internally whether standards conflicting with the proposed application exist. If no conflicting standards exist, the standardization organization publishes the business plan for public comment and a call for cooperation from interested organizations. In contrast to standards, pre-standards are developed in workshops (temporary committee) with a standardization organization acting as a secretary. This committee also decides whether a draft should be published for comment and a pre-standard has successfully been adopted by the committee, it is published by a standardization organization. Different national standardization bodies have their own different names for pre-standards that have been developed in workshops, e.g., a nationally developed pre-standard by DIN (Germany) is called DIN SPEC (e.g., DIN SPEC 91392). Due to their short duration and higher flexibility, pre-standards are well suited for development within research projects with the participation of experts outside the research project.

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3 STANDARDIZATION LANDSCAPE

3.1 General

It is crucial for an R&I project to know the state of the art in the areas relevant for or connected to the project. Since standards reflect this state of the art in a specific area it is essential for R&I projects to have an overview of the standardization landscape related to the project.

This chapter aims to give an overview about current standards and ongoing standardization activities. Moreover, technical committees responsible for standards connected with ZDZW will be identified to which a liaison could be applied for.

This knowledge enables the project to tailor its results or findings to current market requirements and helps ensure that they are interoperable with existing solutions. R&I projects need to consider the developments within other relevant activities. Irrespective of the technical merits of the R&I project developments, these efforts will be inconsequential if developed in isolation and the market decides to follow another path.

Furthermore, the knowledge about related standards also enables the R&I to project to overcome additional challenges and go beyond the current state of the art. On the one hand, an overview of the related standardization landscape offers an R&I project the advantages described above. On the other hand, awareness is raised on where standardization is still needed. This opportunity can be used by the R&I project to implement project results in already ongoing standardization activities or by developing new standards from project results.

3.2 Fields

In the following, the already existing standards of the individual subject areas that are of special thematic relevance for the ZDZW project are outlined.

Zero-Defect

- ISO 1891-4:2018 Fasteners – Vocabulary – Part 4: Control, inspection, delivery, acceptance, and quality

  Abstract: This document specifies terms and definitions for fasteners related to control, inspection, delivery, acceptance and quality.

- ISO 16426:2002 Fasteners – Quality assurance system

  Abstract: ISO 16426 specifies requirements for a fastener quality assurance system to be met by the fastener manufacturers and distributors. These requirements are intended to reduce or prevent the production of non-conforming fasteners with the objective of approaching zero-defects for the characteristics specified.

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- DIN 46454-1 – Zero-defect winding wires - Part 1: General requirements - Electrically enamelled round copper wire with nominal diameter 0,040 mm to 1,600 mm

  Abstract: This standard applies to specifications for electrically zero-defect enamelled round copper wire.

- VDI 2870 Blatt 1:2012 Lean production systems – Basic principles, introduction, and review

  Abstract: VDI 2870 Sheet 1 dates from July 2012 and has been reviewed. It is still valid in parts, but according to the current state of knowledge, it needs to be revised and supplemented in parts. The aim is to supplement VDI 2870, which deals with the fundamentals of holistic production systems, with the important field of occupational health and safety and to check for consistency with the guidelines VDI 2871 and VDI 2872.

- CWA 17918 – Zero-Defects Manufacturing – Vocabulary

  Abstract: The CWA defines terms for Zero-Defect Manufacturing (ZDM) in digital manufacturing with correlation to Industry 4.0 and quality management. The CWA does not define quality management requirements.

Zero Waste

- DIN SPEC 91436 - Reference model for operational waste and recyclables management oriented towards a vision of "zero waste"

  Abstract: This document specifies requirements for waste and recyclables management. Oriented towards a vision of "zero waste", the aim is to reduce the amount of waste and to put unavoidable waste to sustainable use. Criteria for evaluating the degree of implementation are defined with the help of transparent classification. Furthermore, requirements regarding processes, data collection and documentation are specified in order to enable a comprehensive and objectively assessable application. This DIN SPEC is intended for all organizations whose operational processes generate waste.

Life Cycle Analysis

- ISO 21053:2019 - Life cycle analysis and recycling of ductile iron pipes for water applications

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Abstract: This document specifies the evaluation method of life cycle analysis of ductile iron pipes used for water applications as specified in ISO 2531 and ISO 16631.
Studies on economic and environmental impacts are important for utility decision-makers as they seek to balance budget concerns over immediate and long-term needs across acquisition, operations and maintenance, and planned end of life. For authorities and engineers designing pipeline systems, the life cycle cost analysis serves as a tool to study various scenarios to determine the right solution for site-specific conditions and community values, as well as to provide the necessary data to support those decisions.

- ISO 14040:2006 - Environmental management — Life cycle assessment — Principles and framework

  Abstract: ISO 14040:2006 describes the principles and framework for life cycle assessment (LCA) including: definition of the goal and scope of the LCA, the life cycle inventory analysis (LCI) phase, the life cycle impact assessment (LCIA) phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, the relationship between the LCA phases, and conditions for use of value choices and optional elements.
  ISO 14040:2006 covers life cycle assessment (LCA) studies and life cycle inventory (LCI) studies. It does not describe the LCA technique in detail, nor does it specify methodologies for the individual phases of the LCA.
  The intended application of LCA or LCI results is considered during definition of the goal and scope, but the application itself is outside the scope of this International Standard.

- ISO 14044:2006 - Environmental management — Life cycle assessment — Requirements and guidelines

  Abstract: ISO 14044:2006 specifies requirements and provides guidelines for life cycle assessment (LCA) including: definition of the goal and scope of the LCA, the life cycle inventory analysis (LCI) phase, the life cycle impact assessment (LCIA) phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, relationship between the LCA phases, and conditions for use of value choices and optional elements.

- ISO/TS 14074:2022 - Environmental management — Life cycle assessment — Principles, requirements and guidelines for normalization, weighting and interpretation

Abstract: This document specifies principles, requirements and guidelines for normalization, weighting and life cycle interpretation, in addition to those given in ISO 14040 and ISO 14044. The document is applicable to any life cycle assessment (LCA) and footprint quantification study. In particular, this document addresses:

- the use of normalization and its limitations;
- the use of weighting and its limitations;
- the selection or development of weighting factors;
- the generation of single scores;
- requirements that relate to documentation and reporting.

- ISO 20468-8:2022 - Guidelines for performance evaluation of treatment technologies for water reuse systems — Part 8: Evaluation of treatment systems based on life cycle cost

  Abstract: This document provides life-cycle cost (LCC) methodology for treatment systems for water reuse for initial planning as well as later performance evaluation. LCC analysis provides valid information to determine whether the objectives have actually been accomplished and how operations are improved and optimized. Environmental impact is also taken into account in the LCC evaluation.

- ISO/TR 14049:2012 - Environmental management — Life cycle assessment — Illustrative examples on how to apply ISO 14044 to goal and scope definition and inventory analysis

  Abstract: ISO/TR 14049:2012 provides examples about practices in carrying out a life cycle inventory analysis (LCI) as a means of satisfying certain provisions of ISO 14044:2006. These examples are only a sample of the possible cases satisfying the provisions of ISO 14044. They offer "a way" or "ways" rather than the "unique way" for the application of ISO 14044. These examples reflect only portions of a complete LCI study.

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Sustainability

- ISO 9004:2018 - Quality management — Quality of an organization — Guidance to achieve sustained success

  Abstract: ISO 9004:2018 gives guidelines for enhancing an organization's ability to achieve sustained success. This guidance is consistent with the quality management principles given in ISO 9000:2015.
  ISO 9004:2018 provides a self-assessment tool to review the extent to which the organization has adopted the concepts in this document.
  ISO 9004:2018 is applicable to any organization, regardless of its size, type and activity.

- ISO/TS 18101-1:2019 - Automation systems and integration — Oil and gas interoperability — Part 1: Overview and fundamental principles

  Abstract: This document provides requirements, specifications and guidance for an architecture of a supplier-neutral industrial digital ecosystem. It includes a standardized connectivity and services architecture, and a standardized use case architecture with methods to specify atomically re-usable scenarios and events, which can be used to specify the characteristics of standardized industry use cases.

- ISO/IEC TR 30132-1:2016 - Information technology — Information technology sustainability — Energy efficient computing models — Part 1: Guidelines for energy effectiveness evaluation

Abstract: ISO/IEC TR 30132-1:2016 establishes guidelines for improving the energy effectiveness for computing models. Specifically, this document provides
- a reference computing model for evaluating end-to-end energy effectiveness,
- a holistic framework for evaluating the applicability of energy effectiveness improving technologies, and
- guidelines for evaluating energy effectiveness.

Remanufacture

- DIN EN 45553 - General method for the assessment of the ability to remanufacture energy-related products; German version

  Abstract: This European Standard (EN) will provide a general methodology for the assessment of the ability to re-manufacture energy related products. This EN will elaborate the assessment and process of re-manufacturability in a horizontal, cross-product way. However, a correct assessment can only be done in a product-specific way, taking into account specific parameters of a specific energy related product.

- CAN/CGSB-43 - Reconditioning, remanufacturing and repair of drums for the transportation of dangerous goods

  Abstract: Organization and content This standard specifies the requirements for the reconditioning, remanufacturing and repair of steel and plastic drums for the transportation of dangerous goods. This standard consists of three parts and an annex. Part I specifies the general requirements for drum eligibility, and a registered facility's quality management system. Part II specifies the requirements for the reconditioning, remanufacturing and repair of steel drums. Part III specifies the requirements for the reconditioning and remanufacturing of plastic drums.

Repair

- DIN EN 45554 - General methods for the assessment of the ability to repair, reuse and upgrade energy-related products; German version EN 45554:2020

  Abstract: This standard will fulfil requirements in Standardisation request M/543 by defining parameters and methods relevant for assessing the ability to repair and reuse products; the ability to upgrade products, excluding remanufacturing; the ability to access or remove certain components, consumables or assemblies from products to facilitate repair, reuse or upgrade and lastly by defining reusability indexes or criteria.

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- DIN EN IEC 60034-23 - Rotating electrical machines - Part 23: Repair, overhaul and reclamation

  Abstract: This International Standard covers the procedures necessary to ensure the satisfactory rewinding and refurbishment of all types and sizes of rotating electrical machines covered by IEC 60034.

- DIN EN 60706-3 - Maintainability of equipment - Part 3: Verification and collection, analysis and presentation of data

  Abstract: This part of IEC 60706 describes the various aspects of verification necessary to ensure that the specified maintainability requirements of an item have been met and provides suitable procedures and test methods. While maintainability verification as such should be a mandatory part of any maintainability programme (see IEC 60300-3-10), each individual case requires appropriate methods to be carefully selected in order to ensure overall cost effectiveness. This standard also addresses the collection, analysis and presentation of maintainability related data, which may be required during, and at the completion of, design and during item production and operation.

Reduce

- DIN EN 933-11 - Tests for geometrical properties of aggregates - Part 11: Classification test for the constituents of coarse recycled aggregate

  Abstract: This document specifies the reference method for the examination of coarse recycled aggregates for the purpose of identifying and estimating the relative proportions of constituent materials. The reference method is used for type testing and in case of dispute. Other methods can be used for other purposes, such as factory production control, provided that an appropriate working relationship with the reference method has been established.

- DIN EN 1744-6 - Tests for chemical properties of aggregates - Part 6: Determination of the influence of recycled aggregate extract on the initial setting time of cement

  Abstract: Specifies a method for the determination of the influence of water-soluble components from recycled aggregates on the initial setting time of cement.

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- DIN EN 45557 - General method for assessing the proportion of recycled material content in energy-related products

  Abstract: This document specifies a general method for assessing the proportion of recycled material in an energy-related product. This document is applicable as the framework to be used for defining the assessment of recycled materials content in specific product groups.

3.3 TCs

As described in chapter 2, standards are developed by technical committees, each of which is responsible for specific technical areas. In the following, the most important technical committees and industrial consortia are listed and briefly described.

- OPC – Open Platforms Communications

  Scope: OPC is the interoperability standard for the secure and reliable exchange of data in the industrial automation space and in other industries. It is platform independent and ensures the seamless flow of information among devices from multiple vendors. The OPC Foundation is responsible for the development and maintenance of this standard. With the introduction of service-oriented architectures in manufacturing systems, new challenges in security and data modelling have emerged. The OPC Foundation developed OPC UA specifications to address these needs and at the same time provided a platform architecture that was relatively rich in features, open for any technologies, future-proof, scalable, and extensible.

- oneM2M – Standards for M2M and the Internet of Things

  Scope: The purpose and goal of oneM2M is to develop technical specifications which address the need for a common M2M Service Layer that can be readily embedded within various hardware and software. Its purpose is to be relied upon to connect the myriad of devices in the field with M2M application servers worldwide. A critical objective of oneM2M is to attract and actively involve organisations from M2M-related business domains such as: Telematics, intelligent transportation, healthcare, utilities, industrial automation, smart homes, etc. Initially, oneM2M aim is to prepare, approve, and maintain the necessary set of Technical Specifications and Technical Reports related to its goals.

- IEEE – Institute of Electrical and Electronics Engineers Standardisation in the field of electrical and electronic engineering, and telecommunications

- IEC/TC 2 – Rotating machinery

  Scope: To prepare international standards regarding specifications for rotating electrical machines without limitations of voltage, output, or dimensions with the exception of the following:
  - Traction motors within the scope of TC 9: Electric railway equipment
  - Motors and generators within the scope of TC 69: Electric road vehicles and electric industrial trucks
  - Motors and generators for use in cars and commercial vehicles
  - Motors and generators for use in aeronautics or space applications

- IEC/TC 22/SC 22G – Adjustable speed electric drive systems incorporating semiconductor power converters

  Scope: To prepare international standards for electronic power conversion equipment in adjustable speed electric drive systems, including the means for their control, protection, monitoring and measurement. Excluded are traction applications and electric vehicles.

- IEC/TC 56 – Dependability

  Scope: To prepare international standards in the field of dependability, in all appropriate technological areas, including those not usually handled by IEC Technical Committees. Dependability is the ability to perform as required and when required and is time dependent in application. Dependability can be expressed in terms of core attributes of availability, reliability, maintainability, and supportability that are tailored to application-specific functional and service attributes. TC 56 standards are related to products, processes, and management activities. The standards provide systematic methods and tools for dependability assessment, technical risk assessment and management of services and systems throughout their life cycles. Dependability is a technical discipline that is important in quality management, asset management, risk management and financial decision making. It is managed through life cycle processes involving availability and its core performance attributes of reliability, maintainability, and supportability, as well as application-specific performance attributes such as recoverability, survivability, integrity, security for products, and service dependability evaluation.

- IEC/TC 65 – Industrial-process measurement, control, and automation

  Scope: To prepare international standards for systems and elements used for industrial process measurement, control, and automation. To coordinate

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standardisation activities which affect integration of components and functions into such systems including safety and security aspects. This work of standardisation is carried out in the international fields for equipment and systems.

- IEC/TC 65/SC 65B – Measurement and control devices

  Scope: To prepare international standards in the field of specific aspects of devices (hardware and software) used in industrial process measurement and control, such as measurement devices, analysing equipment, actuators, and programmable logic controllers, and covering such aspects as interchangeability, performance evaluation, and functionality definition.

- IEC/TC 65/SC 65E – Devices and integration in enterprise systems

  Scope: To prepare international standards specifying:
  (1) Device integration with industrial automation systems. The models developed in these standards address device properties, classification, selection, configuration, commissioning, monitoring and basic diagnostics.
  (2) Industrial automation systems integration with enterprise systems. This includes transactions between business and manufacturing activities which may be jointly developed with ISO TC184.

- ISO/TC 184 –Automation systems and integration

  Scope: Standardization in the field of automation systems and their integration for design, sourcing, manufacturing, production and delivery, support, maintenance and disposal of products and their associated services. Areas of standardization include information systems, automation and control systems and integration technologies.

Note: There will be active collaboration with the relevant technical committees responsible for areas such as machines, manufacturing resources and facilities, robotics, electrical and electronic equipment, PLC for general application, quality management, industrial safety, information technologies, multi-media capabilities, and multi-modal communication networks.

3.4 Other standards developing organizations (SDOs)

Due to our research, ZDM is not covered by other SDOs. The ZDM experts which are involved in the ZDM CWAs also didn't address any existing activity regarding the elaboration of future ZDM standards.

3.5 Locating ZDM in the standardization landscape

To get an impression on where ZDM could be located in the standardization landscape, first the definition of ZDM was observed.

ZDM is defined as "holistic approach for ensuring both process and product quality by reducing defects" [CWA17918].

The definition is extended by three notes.

1) zero-defect manufacturing uses mainly data-driven technologies, e.g., originating from Big Data and Machine Learning domains/areas/fields for predictive or prescriptive analytics referred to as zero-defect manufacturing tools"

2) zero-defect manufacturing requires that no defective products leave the production site and reach the customer by performing 100 % inspection

3) zero-defect manufacturing aims at higher manufacturing sustainability

The definition itself clearly locates the topic under quality matters. Quality itself is very well connected with standards. One main benefit of using standards is to ensure a certain quality level. The keyword "quality" is associated with about 11000 ISO standards.

As ZDM is a holistic approach, the question arises if it is a quality management system or a sector specific implementation of ISO 9001. In the project plan of the CEN workshop, ZDM is seen as a method to ensure quality, but not as a quality management system itself. The same approach is also done by Six Sigma, which is a well-known statistical method to ensure quality in manufacturing. Therefore, locating ZDM in ISO/TC 176 "Quality management and quality assurance" is not really appropriate.

The first note reveals that ZDM in the present understanding requires Industry 4.0 so that it can build upon large amounts of data and use techniques like machine learning. This would allow us to locate ZDM in Industry 4.0 committees like ISO/TC 184 "Automation systems and integration", IEC/TC 65 "Industrial-process measurement, control, and automation" or ISO/IEC JTC 1 "Information technology".

The second note emphasizes the level of quality and the aim to reach 100 % inspection. The term 100 % inspection was used in ISO 3534-2:2006 in connection with six sigma. The six sigma standards are maintained by ISO/TC 69 "Applications of statistical methods" which also elaborated ISO 18404:2015 "Quantitative methods in process improvement - Six Sigma - Competencies for key personnel and their organizations in relation to Six Sigma and Lean implementation" which is not only dedicated to six sigma, but also to lean manufacturing. Although, ZDM can be used a tool to increase quality, like six sigma, it is no statistical method. Therefore, locating ZDM in ISO/TC 69 “Applications of statistical methods” wouldn’t be appropriate.

The third note points at the connection of ZDM with sustainability. ZDM conforms for example with the basics of Circular Economy and tries to avoid waste by taking off defective parts from production as early as possible and by monitoring machines to avoid the creation of defective parts. This is done using Industry 4.0 and IT techniques, so ZDM is clearly more located in the Industry 4.0 domain.

Lean manufacturing is the most similar approach to ZDM, so the location of lean manufacturing in the standardization landscape could also help to locate ZDM. Currently, only ISO 18404:2015 (Six Sigma and Lean implementation) is more or less directly dealing with lean manufacturing. So, there is no TC maintaining lean standards.

The international TCs most relevant for the Industry 4.0 domain can be found in the DIN Standardization roadmap Industry 4.0 [DINRoadmapI4.0_5]. This list shows the most relevant subcommittees (SCs) and working groups (WGs) from the already mentioned IEC/TC 65, ISO/IEC JTC 1 and ISO/TC 184 and adds some more TCs.

To see which of the following TCs, SCs or WGs fits best, it is important to keep in mind, that ZDM is a holistic approach for ensuring both process and product quality, utilizing Industry 4.0 technique when go through the table.

TABLE 2 OVERVIEW OF MOST RELEVANT ISO AND IEC TCS IN THE INDUSTRY 4.0 DOMAIN [DINROADMAPI4.0_5]

IEC – International Electrotechnical Commission

- IEC/TC 65 Industrial process, measurement, control and automation
- IEC/TC 65/WG 10 Security for industrial process measurement and control – Network and system security
- IEC/TC 65/WG 16 Digital Factory
- IEC/TC 65/WG 19 Lifecycle management for systems and products used in industrial process measurement, control and automation
- IEC/TC 65/WG 20 Industrial process measurement, control and automation – Framework to bridge the requirements for safety and security
- IEC/TC 65/WG 23 Smart Manufacturing Framework and System Architecture
- IEC/TC 65/WG 24 Asset Administration Shell for Industrial Applications
- IEC/SC 65A System Aspects
- IEC/SC 65B Measurement and control devices
- IEC/SC 65C Industrial Networks
- IEC/SC 65E Devices and integration in Enterprise systems

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ISO/IEC JTC 1 Joint Technical Committee for Information technologies • ISO/IEC JTC 1/SC 27 Information security, cybersecurity and privacy protection • ISO/IEC JTC 1/SC 27/WG 3 Security evaluation, testing and specification • ISO/IEC JTC 1/SC 27/WG 4 Security controls and services • ISO/IEC JTC 1/SC 31 Automatic identification and data capture techniques • ISO/IEC JTC 1/SC 41 Internet of things and digital twin • ISO/IEC JTC 1/SC 42 Artificial Intelligence • ISO/IEC JTC 1/AG 7 Trustworthiness • ISO/IEC JTC 1/AG 8 Meta Reference Architecture and Reference Architecture for Systems Integration • ISO/IEC JTC 1/AG 11 Digital Twin
ISO – International Organization for Standardization • ISO/TC 184 Automation systems and integration • ISO/TC 184/SC 4 Industrial data • ISO/TC 108/SC 5 Condition monitoring and diagnostics of machine systems • ISO/TC 261 Additive Manufacturing • ISO/TC 292 Security and resilience • ISO/TC 299 Robotics • ISO/TC 307 Blockchain and distributed ledger technologies

The committees and groups which seem most relevant are the following, which are now listed with their scope.

- IEC/TC 65 Industrial process, measurement, control and automation

  Scope: To prepare international standards for systems and elements used for industrial process measurement, control and automation. To coordinate standardization activities which affect integration of components and functions into such systems including safety and security aspects. This work of standardization is to be carried out in the international fields for equipment and systems.
  TC 65 has a Cybersecurity horizontal function in accordance with IEC Guide 108, defined as follows: Cybersecurity for Operational Technologies

  → ZDM gives guidance on how to set up industrial processes, how to measure and control the entities, requiring an automated system. It would fit well to the scope.

- IEC/TC 65/WG 16 Digital Factory

  Scope: Definition of the Digital Factory framework, which specifies model elements and rules for creating and managing digital representations of production systems. These digital representations include role-based requirement information as well as physical equipment information and are based on well-defined semantics.

  → As this WG is just dealing with digital representations, ZDM is not within the scope of this WG.

- IEC/TC 65/WG 23 Smart Manufacturing Framework and System Architecture

  Scope: The task of WG 23 is to establish a framework for Smart Manufacturing (SM) concepts and standards within the scope of TC 65 and in particular:
  - Identification of SM concepts relevant for TC65, and analysis of their relations with TC 65 standards;
    - new technologies (e.g., AI, edge, cloud, IIoT)
    - data exchange and management
    - new communication technologies

  Recommendations for proper coverage of SM needs by standards portfolio within TC65 scope, including potential harmonization of TC65 standards.
  This work includes the development of deliverables on topics such as
  - SM terms and definitions;
  - SM use cases;
  - SM recommendations for cybersecurity;
  - SM recommendations for safety.
  - SM related usage of new technologies
  - SM related analysis of market and innovation trends

  Identification of needs for harmonization and/or interfacing with standards in related domains act as TC65s main interface to SyC SM cooperation within TC65 and outside TC65 with other SM related entities including ISO TC184, SyC SM, JTC1 SC41, JTC1 SC42, etc.
  Note that the work on SM Reference Model(s) is outside the scope of WG23 as it is carried out by JWG21

  → As ZDM in the current understanding in combination with Industry 4.0 is an innovative approach and therefore fits to the scope of IEC/TC 65/WG 23. The recent publication of IEC TR 63283-5 ED1 Industrial-process measurement, control and automation – Smart manufacturing – Part 5: Market and innovation trends analysis, which analyses ZDM as emerging technology underlines this fit.

- IEC/SC 65A System Aspects

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Scope: To prepare international standards regarding the generic aspects of systems used in industrial process measurement, control and manufacturing automation: operational conditions (including EMC), methodology for the assessment of systems, functional safety, etc. SC65A also has a safety pilot function to prepare standards dealing with functional safety of electrical/electronic/programmable electronic systems.

→ As ZDM is a holistic approach and therefore more general, it may fit within the scope of IEC/SC 65A.

- ISO/TC 108/SC 5 Condition monitoring and diagnostics of machine systems

  Scope: Standardization of the procedures, processes and equipment requirements uniquely related to the technical activity of condition monitoring and diagnostics of machines systems in which selected physical parameters associated with an operating machine system are periodically or continuously sensed, measured and recorded for the interim purpose of reducing, analysing, comparing and displaying the data and information so obtained and for the ultimate purpose of using this interim result to support decisions related to the operation and maintenance of the machine system.

  → Condition monitoring and diagnostics of machine systems is one of the major aspects of ZDM, so that would be covered by the scope. However, aspects such as monitoring of the workpieces and the general approach are not covered. In addition, the TC is more focused on physical shocks and vibrations.

- ISO/TC 184 Automation systems and integration

  Scope: Standardization in the field of automation systems and their integration for design, sourcing, manufacturing, production and delivery, support, maintenance and disposal of products and their associated services. Areas of standardization include information systems, automation and control systems and integration technologies.
  Note: There will be active collaboration with the relevant technical committees responsible for areas such as machines, manufacturing resources and facilities, robotics, electrical and electronic equipment, PLC for general application, quality management, industrial safety, information technologies, multi-media capabilities, and multi-modal communication networks.

  → ZDM is strongly connected with automation systems. It would fit well to the scope.

- ISO/IEC JTC 1 Joint Technical Committee for Information technologies

  Scope: Standardization in the field of information technology.

→ The Scope of ISO/IEC JTC 1 is quite wide, so ZDM would fit to it as it is mainly based on IT technologies. The topics of ISO/IEC JTC 1 like "Internet of things and digital twin" or Smart cities, are quite generic

DIN will approach the CEN/CLC/ETSI coordination group and the ISO/IEC I4.0 coordination group to introduce ZDM to the experts and to ask them for their opinion where ZDM could be placed best.

If a fitting TC would agree on the elaboration of a future ZDM standard, an active participation could be enabled via a liaison. Therefore, ZDZW has to apply for a liaison with the respective TC. If the TC agrees, ZDZW could send an expert to the WG meetings for active participation.

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4 CWA ZDM BASIC PRINCIPLES AND REQUIREMENTS

4.1 General Motivation

Companies use a variety of quality management methods to improve their operational performance to attain high-quality production. The application of Industry 4.0 technological advances along the production process chain has led to a fundamental change in manufacturing quality management systems. These advances make it possible to achieve unprecedented levels of manufacturing quality and to produce high-quality products most efficiently, i.e., to realize the paradigm of zero-defect production. ZDM is the latest and most advanced approach for quality assurance. ZDM is composed of four main strategies: “Detect” and “Predict” that are the triggering ZDM strategies, and the “Repair” and “Prevent” that are the action ZDM strategies. The three ZDM pair strategies are “Detect-Repair”, “Detect-Prevent” and “Predict-Prevent”. The main difference of ZDM with the traditional quality assurance methodologies is the fact that ZDM ensures 100% of the products are inspected via any method, either detection or prediction. It is impossible to achieve ZDM if not all the products are inspected. In traditional quality improvement methods such as Six Sigma, Lean manufacturing, Lean Six Sigma, Theory of Constraints, and Total Quality Management, the analysis starts after the production has started and defects or quality issues start occurring. Modern technological advancements provided capabilities that were not possible in the past. These technological advancements initiated the emergence of another QMS method named ZDM. One major change in ZDM is about the flow of information. Indeed, ZDM uses both historical and real-time data to prevent product from defect. Doing this, ZDM combines several quality control applications concerning production lines, machinery, automation applications, and supply chain processes. This is possible thanks to the development of IT systems and Industry 4.0. The core concept of ZDM is “Make it right at first attempt”. [CWA_Application2023]

Please find an overview of ZDM in [Psarommatis2020] and [Psarommatis2022a].

The objectives of the planned workshop are to define basic principles of ZDM, based on the terminology, which was recently created in a CEN-CENELEC Workshop and is available as CWA 17918:2022. It should contain the steps on how to get to a ZDM manufacturing line and could be used by manufacturers to implement ZDM (both on existing and new manufacturing lines). A defined set of requirements will support the manufactures to ensure following the principles of ZDM.

Further information of CWA 17918:2022 can be found in [Sousa2022] and work on an Ontology based on it in [Psarommatis2023a]. Additional information to ZDM can be found in [Psarommatis2021, Psarommatis2022b, Psarommatis2023b].

4.2 Certification

Certification provides manufacturers with a credible endorsement from recognized authorities or industry experts. A certificate assures consumers that the products, processes, or employees have met rigorous standards, thus instilling trust and confidence in the brand. Certified manufacturers gain access to broader markets, both domestic and international. Many markets, especially in regulated industries, require certification as a prerequisite for entering their supply chains or serving as a preferred vendor. Compliance with industry-specific standards becomes a non-negotiable aspect of market expansion.

Another essential benefit of certification is the potential improvement in product quality. Certification often involves strict quality control measures, which can significantly enhance the overall product quality. By adhering to established standards, manufacturers can identify and rectify deficiencies, leading to greater customer satisfaction and reduced product recalls. Moreover, certifications help mitigate potential risks by ensuring that products, processes, and infrastructure comply with industry best practices and legal requirements. In turn, this minimizes liability exposure for manufacturers in case of any unfortunate events or accidents.

There are three different types of certifications or better called conformity assessments. The first type is the 1st Party Conformity Assessment. Manufacturers can assess their own products, processes, or employees, allowing for greater control over the certification process. This internal control can be cost-effective as it eliminates the need to engage external certifying bodies, reducing certification expenses. Additionally, regular internal assessments encourage ongoing improvement within the organization. However, 1st party certifications lack the impartiality and external validation associated with third-party assessments, which might raise consumer scepticism about the credibility of such certifications.

The second type is the 2nd Party Conformity Assessment. This involves assessments conducted by the manufacturer's customers or partners, building trust and confidence in the supply chain. Customers can focus on specific areas of concern, addressing their unique requirements. However, 2nd party assessments may not cover all aspects of certification standards, leading to potential blind spots. Furthermore, the assessing party may have its own interests in mind, which could impact the objectivity of the assessment.

The third and perhaps most widely recognized type is the 3rd Party Conformity Assessment. These certifications are conducted by independent, accredited bodies, lending higher credibility to the certification. Such certifications are universally accepted, making it easier for manufacturers to access global markets. External assessors ensure a fair and unbiased evaluation, maintaining the integrity of the certification process. However, engaging external certifying bodies can be more expensive than internal or 2nd party assessments, and the certification process may take longer due to scheduling and coordination.

Manufacturers can certify for example employees, processes, and infrastructure. Certifying employees' skills and expertise demonstrates a competent workforce capable of meeting industry demands. It also improves employee morale and motivation through recognized achievements and attracts top talent, as certified professionals are often preferred in the job market. Process certification leads to consistency and efficiency in production, reducing waste and lowering costs. It also ensures the company meets industry benchmarks and best practices for optimized outcomes, while promoting greater transparency and reliability in process execution. Infrastructure certification offers assurance of safe working conditions and adherence to environmental regulations. It enhances risk management and disaster preparedness while strengthening the company's reputation for responsible and sustainable practices.

In conclusion, certification holds immense value for manufacturers as it enhances credibility, expands market reach, and ensures compliance with standards. While 1st and 2nd party assessments offer internal control and tailored evaluations, 3rd party assessments stand out for their impartiality and global recognition.

4.3 Conduction of the CEN-CLC Workshop

The need for the CEN Workshop Agreement (CWA) about ZDM was expressed within the horizon project ZDMP and in the CEN-CLC Workshop ZDM term, where a terminology CWA was created. Together with the IEC TR 63283-5 ED1, which contains an analysis about ZDM as emerging technology, the documents form a first step towards full standards about ZDM. The envisaged CEN-CLC Workshop is currently in the initiation phase and will officially kick-off at 2023-09-08 in an online meeting. The project plan of the workshop was sent to all relevant European technical committees (TCs) and to the CEN-CLC BT (board technique) and the elaboration of the CWAs was accepted.

The Workshop will elaborate two CWAs within 18 months, so that the final documents are available at the project end. During this time, DIN will take care about the procedural part and will conduct the meetings. The CWAs will have the titles: “Zero-Defect Manufacturing – Basic Principles” and “Zero-Defect Manufacturing – Requirements”.

The CWAs can serve as a basis for a full standard, and it is planned to propose an international standard, based on the CWAs. For this purpose, the experts of a TC need to be convinced that the topic is important. A proposal for a new standard can be handed in by the TC or by a national committee and the TC needs to accept the proposal which requires 5 countries which are motivated to actively contribute to the elaboration of the new standards. In cases where no fitting WG exists, a new WG needs to be founded first.

5 STANDARDIZATION WORKSHOP

5.1 Aim

The aim of the workshop was to familiarize the partners with the upcoming CEN-CENELEC workshop and to start the process of finding a common understanding or a common perspective on ZDM.

5.2 Method

Usually, the standardisation workshop is needed to generate ideas about missing standards and to agree on the most suitable topic to start standardisation activities. In the case of ZDZW, at this stage DIN already knew that a CEN-CENELEC workshop with the aim to create a CWA on the basic principles and on the requirements of ZDM would be the most suitable standardisation activity. Accordingly, the workshop concept had to be pointed towards the upcoming CEN-CENELEC workshop.

Together with Foivos Psarommatis, an expert for ZDM, DIN clarified in advance what information was needed for the workshop and how we could best get the partners in the mood for the workshop. The concept was created in several online meetings and discussed with other ZDM experts.

One important aspect was to connect ZDM experts external to the project with project partners of ZDZW. Both experts and project partners needed to be guided through the workshop and to get to know each other. The experts are also active in other horizon projects in this field.

5.2.1 Icebreaker

The first part of the workshop was dedicated to a warmup, so that the partners are able speak more freely and to let their thoughts and their ideas flow. The partners were asked to have their camera on and had to raise hand to questions like:

- Who is currently working in the north of Europe?
- Who is currently working in the south of Europe?
- Who is currently working from home?
- Who already had a coffee, today?
- Who already had a tea, today?

It was taken care that the questions or their answers don't imply positively or negatively associated clichés.

5.2.2 Presentations

To prepare the partners for the later discussion and to draw their attention to ZDM and specific aspects, the following talks were organized:

- Vision of the working group (Foivos Psarommatis, ZDM expert)
- Brief Presentation about ZDM (Foivos Psarommatis, ZDM expert)

- Presentation about ZDM Vocabulary and basic principles (Foivos Psarommatis, ZDM expert)
- Basics about Standardization
  (Christian Grunewald, DIN, standardization specialist)
- Implementation of ZDM at HSD – Motivation and experiences (Paolo Galli, HSD, ZDM implementation use case)
- Lean, Six Sigma and Certification (Daryl Powell, ZDM, Lean and Six Sigma expert)

5.2.3 Introduction of collaborative whiteboard

The workshop was mainly conducted using Conceptboard, a collaborative whiteboard. To ensure that the participants are able to interact properly, the board was introduced with some small tasks like putting sticky notes in specific areas and writing the name on it.

5.2.4 Live poll and discussion

The partners had to self-estimate their knowledge about ZDM, Six Sigma, Lean, certification and standardization. This allowed the participants to get a better overview of the group and it also gave us additional information to for weighting the answers from the later creative part of the workshop.

There were also questions regarding the expectations of the partners regarding the planned CWAs and their motivation and envisaged effort to take part in the consent building process. Based on the personal expertise, the partners were also asked which type of certification is most beneficial for manufacturers using ZDM and if they would rather certify persons, processes or infrastructure/facilities.

5.2.5 Development phase

The main focus was laid on two questions:

- Which aspects of ZDM need to be explained in the CWA?
- Which requirements need to be defined in the CWA?

The questions were handled one after the other. For each question, the participants were asked to provide their name, to fill in 5 sticky notes and to put the most important sticky note to the bottom. Subsequently, the participants should have a look at other sticky notes which were flagged as most important and should mark them with if they were also important. This way, the participants prioritized their ideas and thought about other ideas. After the prioritization, there was room for discussion.

5.2.6 Feedback

At the end of the workshop, feedback was collected. To increase the amount of feedback in the given time, the topics of the workshop were pinned on the board and the participants were asked to put sticky notes, related to the topic. The participants were also encouraged to unmute and to give short feedback in classical form.

5.3 Results

The participants were from different sectors and with different level of expertise regarding ZDM, certification, six sigma, lean and standardization. Therefore, a variety of different viewpoints and ideas was provided.

5.3.1 Expectations on the CWAs

DIN asked the participants: "When is the standardization document a success for you?" and clustered the expectations.

Easy to implement
When it is easy to implement in daily work
Easy-to-understand and easy-to-implement definitions of procedures
Clear to understand, easy to implement

Clear goals, definitions, rules, procedures
Clear goals and procedures to adopt it
Clear definitions
Needed to be able to speak a common language and set clear goals.
clear guideline and executable
when it gives goal s and methods to reach it
General rules for suppliers and clients

Useful
When it is accessible and helpful to manufacturers to increase its quality

Widely/highly adopted, technology spread among the manufacturers → Successful technology transfer
Implement inspection technologies in to the manufacturing site by developing procedures and work instructions.
When it is widely adopted, referenced and used practically (gives value to the adopters)
When it provides value to stakeholders
When is highly adopted.
When it is used by the end stakeholders
When we use it and it works on the scenario we need
To be used by the industry

Uptake into standardization committees
When it contributes to the standardisation activities of committees
Examples / UC are always welcome [in technical committees]

Competitive edge
When case companies reach high level of competitiveness

Guidelines for SMEs
Guidelines for standardization already in the start-up company/prototype development phase of a given technology

5.3.2 Experience in Standardization

Many participants don't have experience with standards, but the majority uses standards and 7 participants already participated in standardization activities

- 13 have never looked into any standard
- 16 use standards
- 5 participate(d) in a CEN Workshop
- 2 participate(d) in a technical committee (TC)

5.3.3 Experience in ZDM, certification, lean and six sigma

Most partners have small or medium experience in the focused areas. Some partners are very experienced ZDM experts and other partners have much experience in lean manufacturing and six sigma. A connection between knowledge in six sigma and lean manufacturing can be clearly seen. For data protection, the graphics are not published within this deliverable. The standardization workshop was well composed to cover different angles and views.

5.3.4 Engagement in a future CEN-CENELEC Workshop

Do you want to work in a core group / editing team on a regular basis?
1 weekly
1 biweekly
10 monthly
8 bimonthly
8 no → just keep me in the loop

The participants are very motivated to be part of the CEN-CENELEC workshop. 12 Participants are willing to work and discuss at least on a monthly basis. The overall number of participants will be 20.

5.3.5 Certification

The participants clearly prefer 2nd party and 3rd party certification. For the participants it is equally thinkable of certifying persons, processes as well as infrastructure.

5.3.6 Which aspects of ZDM need to be explained in the CWA?

Over 90 aspects were collected in the first part of the development phase of the workshop. The aspects mentioned were truly diverse, so that there were only a few multiple responses. This is why, for example, it was not possible to create a meaningful word cloud. The aspects mentioned can essentially be divided into two categories. One category is formed by aspects that directly affect ZDM. These are, for example, the strategies detect, predict, repair and prevent. The other category contains aspects that are indirectly related to ZDM. These are, for example, "data handling and sharing" or "non-destructive inspection technologies". Figure 5: ZDM aspects part 1 and Figure 6 show the clustered terms. In the further course, the clusters are prioritized and the extent to which the individual topics can and should be addressed in the CWA is examined.

FIGURE 5: ZDM ASPECTS PART 1

FIGURE 6: ZDM ASPECTS PART 2

5.3.7 Which requirements need to be defined in the CWA?

The participants provided over 80 requirements or fields of requirements which from their perspective need to be defined in the CWA. The clustered sticky notes are shown in Figure 7. In a later step, the requirements could also be categorized after qualification, processes and infrastructure.

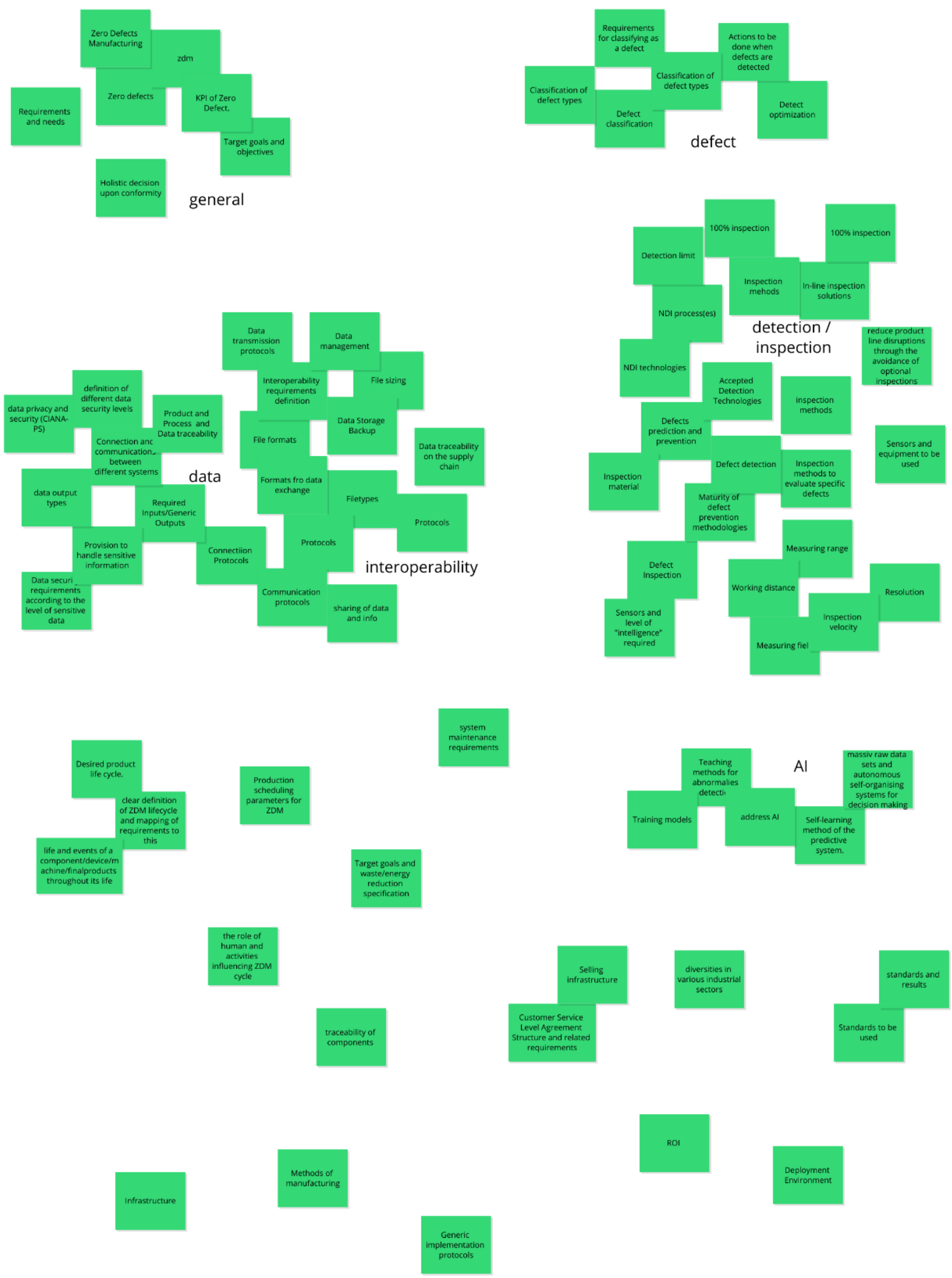


FIGURE 7: ZDM REQUIREMENTS

5.4 Feedback

The partners had a positive experience in the workshop and expressed their interest in the upcoming activities.

On the digital whiteboard, the partners were asked if they want to highlight something.

As ZDZW is also about zero waste, it was highlighted that the zero-waste aspect should be added to the ZDM considerations.

Some partners are convinced that ZDM will set future manufacturing standards.

5.5 Actions

Actions can be derived from the input of the development phase. In this phase, the participants were tasked to note their ideas, including ideas which are highly creative and not perfectly fitting to the question. To focus on the best ideas, the participants were asked to pick the most important idea at the end. As the ZDM topic is quite complex, the reduction of ideas by picking just one idea per person would have been too strong. Accordingly, DIN took all ideas into account, knowing that some ideas might be not pointed specifically to the question or the envisaged CWAs. In the future CEN-CENELEC Workshop, the expectations and proposed requirements will be prioritized and checked if they are suitable to be included in the CWAs. Together with the academic literature and the theoretical and practical background of the ZDM experts, the participants are well composed to elaborate a CWA. Thus, there is a risk of not diverging in the given timeframe, so the participants are well advised to orientate on the literature first.

6 SURVEY

6.1 Aim

Compliance with standards is beneficial. The most important benefit is a high interoperability with other platforms, software solutions, and the substantial number of different sensors and machines. Since ZDZW aims to be interoperable, the compliance with different standards, especially concerning interfaces and communication, is natural.

To support ZDZW's goals of being interoperable and expandable, it is important that the project partners have knowledge about additional standards which could be relevant. As a first step, DIN was introduced as contact point for standards in the plenary meeting, highlighting the benefits of standards and standardization. Subsequently, using information from the project partners

Since DIN is highly active in the areas of Industry 4.0 and Circular Economy and has also already gained experience in the area of ZDM, a list of standards relevant for the topics of ZDZW already exists. To support the project partners in the best way, the standards list had to be adapted to the needs of the project partners. For this purpose, a survey was conducted, which all project partners were asked to answer.

6.2 Results

The survey was answered by 19 partners, which is sufficient for the purpose of the survey.

DIN can conclude that the majority of the project partners rate their knowledge of standardization as rather low.

Another finding from the survey is that the project partners have never been and are not currently active in a standardization committee or other organization that develops standardization documents.

However, a few project partners have participated in the development of pre-standards, such as a CWA (CEN Workshop Agreement) or consortium standards.

The collection of keywords was the main purpose and can be seen in Figure 8: Keywords for the refinement of the standards research.

The refinement of the existing standards list will be done on the basis of the given keywords. The importance of the terms will be weighted and only terms which fit to the scope of ZDZW will be taken into account.

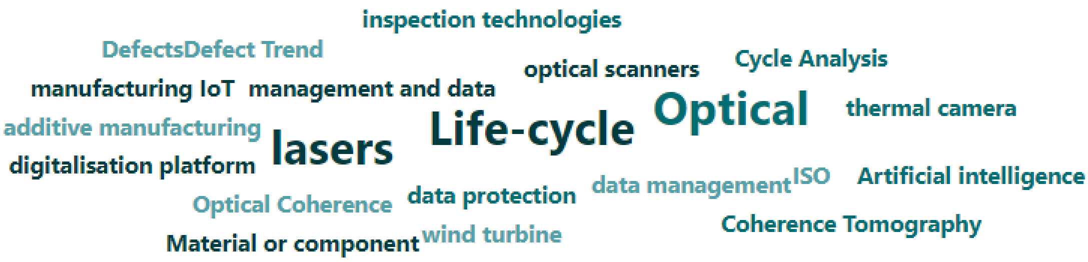


FIGURE 8: KEYWORDS FOR THE REFINEMENT OF THE STANDARDS RESEARCH

7 SUMMARY

The aim of the Deliverable D3.10 is to provide an overview about existing standards and standardization activities to the ZDZW project partners. Furthermore, this document addresses the standardization strategy which will be implemented for ZDZW.

To get a better understanding of why there is currently a need for further standardization activities regarding ZDM, the third chapter "Standardization landscape", shows which standardization activities relating to ZDM already exist or are currently ongoing. From this it can be concluded that there is currently a lack of concrete requirements and criteria defining what exactly ZDM is, i.e., what characteristics should ZDM-compliant manufacturing companies have, how are the individual production steps connected with each other, how can a manufacturing company achieve overall efficiency increases and waste minimization with the help of ZDM etc. Another important open question is how manufacturing companies can prove or verify that they are successfully applying ZDM and are therefore ZDM-compliant. To solve this and further define the topic of ZDM, it is envisaged to initiate a CEN Workshop on the topic of ZDM basic principles and requirements.

The need for this CWA emerged from the preceding project ZDMP, where a CWA on terminology for ZDM-related terms was already published (CWA 17918:2022). As a first step, a workshop was held in ZDZW to familiarize the partners with the upcoming CEN-CENELEC workshop and to establish a common understanding or a common perspective around the topic. In addition, it was specifically asked which partners are willing to use further resources during the development of the CWAs.

In order to achieve high durability and to reach as many experts as possible, it is planned to use the CWAs resulting from ZDZW as the basis for full standards. Either at European level, as an EN standard, or at international level, as an ISO standard. For this purpose, it is essential to place the CWAs in the corresponding European or international technical committees as early as possible in order to be in the focus of the ongoing activities. For this reason, this deliverable analyses the respective TCs to determine how to successfully place the planned CWAs.

Funded by the European Union

8 OUTLOOK

The focus for standardization in the European research project ZDZW is on the continuation and successful implementation of the standardization activities based on the previous work within ZDMP, where a terminology CWA was developed.

Currently, the topic of ZDM is not dealt with extensively in the standardization and there are few ZDM experts, which is why ZDM is dealt with as a subtopic in some TCs, but where ZDM is not the focus.

The envisaged CEN-CLC Workshop is currently in the initiation phase and will officially kick-off at 2023-09-08 in an online meeting. The project plan of the workshop (see Annex 1) was sent to all relevant European technical committees (TCs) and to the CEN-CLC BT (board technique) and the elaboration of the CWAs was accepted.

The Workshop will elaborate two CWAs within 18 months, so that the final documents are available at the project end. During this time, DIN will take care about the procedural part and will conduct the meetings.

The planned CWAs about ZDM Basic Principles and Requirements have the potential to serve as a basis for future standardization efforts on either European or international level.

This would have the effect of bringing ZDM more into the focus of the standardization community and thus more experts could be attracted to carry out standardization activities in European or international TCs. As a result, the topic of ZDM could be promoted further and a solid community could be created around the topic.

Since the CWAs are developed within ZDZW, they can be used as a tool for the dissemination of own research results. In ZDZW, concrete use cases exist, the results of which can be incorporated into the CWAs. This would have the result that ZDZW can benefit from an increase in transparency and increased visibility within the standardization network. This would once again ensure that ZDM becomes the focus of further public attention.

Draft Project plan for the CEN-CENELEC Workshop on "Zero Defect Manufacturing – Basic Principles and Requirements"

Requests to participate in the Workshop and/or comments on the project plan are to be submitted by 2023-08-20 to christian.grunewald@din.de[9]

Recipients of this project plan are kindly requested to name all patent rights known to them to be relevant to the Workshop and to make available all supporting documents.

Berlin, 2023-05-24 (Version 1)

[9] Applications for participating in the Workshop and comments on the project plan that are not received by the deadline do not need to be taken into consideration. Once constituted, the Workshop will decide whether or not to consider the comments received in good time.

1 Status of the project plan

Draft project plan for public commenting (Version 1.0)

This draft project plan is intended to inform the public of a new Workshop. Any interested party can take part in this Workshop and/or comment on this draft project plan. Please send any requests to participate or comments by e-mail to christian.grunewald@din.de.

All those who have applied for participation or have commented on the project plan by the deadline will be invited to the kick-off meeting of the Workshop on 2023-09-08.

Approved project plan for CWA development adopted at the kick-off meeting of the Workshop on <yyyy-mm-dd> (Version <No.>)

2 Workshop proposer and Workshop participants

1.1 Workshop proposer

Person or organisation	Short description and interest in the subject
Dr. Foivos Psarommatis Senior Researcher University of Oslo, Norway/ Universitat Politècnica de València, Spain	Foivos Psarommatis is an engineer active in the areas of design and quality improvement of manufacturing systems. Currently, he is a senior researcher at University of Oslo (UiO) and Universitat Politècnica de València (UPV). More specifically is a pioneer in the area of Zero-Defect Manufacturing (ZDM), as is the first who modernized and set the foundation of modern ZDM. His scientific interests and motivation are around Industry 4.0/5.0 and on how ZDM can be applied efficiently to production systems, focusing on the decision making, scheduling and design of systems, with ultimate goal to achieve true sustainable manufacturing. His work is also cited in IEC TR 63283-5.

1.2 Other potential participants

This CWA will be developed in a Workshop (temporary body) that is open to any interested party. The participation of other experts would be helpful and is desired. It is recommended that:

- manufacturers who applied zero defects manufacturing
- manufacturers who are interested in zero defects manufacturing
- manufacturing quality experts
- I4.0 experts

take part in the development of this CWA.

1.3 Participants at the kick-off meeting

The following persons or organisations already signed up to the kick-off meeting prior to the publication of the draft project plan.

Person	Organisation
Foivos Psarommatis	University of Oslo/ Universitat Politècnica de València
Oscar Salgado	IKERLAN, Spain
Daryl Powell	SINTEF, Norway
Evangelos Kitsos	Epariston, Greece
Olga Meyer	Fraunhofer IPA, Germany
Paulo Rodrigues	Consulgal, Portugal
Angelo Facondini	HSD SPA, Italy
	Profactor GmbH, Austria
	Instituto Tecnologico de Informatica, Spain
João Sousa, Artem Nazarenko	UNINOVA, Portugal
Universitat Politècnica de València, Spain	Raul Poler, Francisco Fraile, Joan Lario, Miguel A. Mateo-Casali
	Video Systems, Italy
Victor Azamfirei	Mälardalens universitet, Sweden
Jacopo Cassina	Holonix, Italy
Christian Grunewald	DIN
Yusuf Yilmaz	DIN

1.4 Registered Workshop participants

The following persons or organisations have registered as Workshop participants at the kick-off meeting and will actively participate in the development of the CWA.

Person	Organisation

Workshop Chair	Workshop Chair
Workshop Vice-Chair	Workshop Vice-Chair
Workshop secretariat	Workshop secretariat

3 Workshop objectives and scope

1.5 Background

Companies use a variety of quality management methods to improve their operational performance to attain high-quality production. The application of Industry 4.0 technological advances along the production process chain has led to a fundamental change in manufacturing quality management systems. These advances make it possible to achieve unprecedented levels of manufacturing quality and to produce high-quality products most efficiently, i.e., to realize the paradigm of zero-defect production. Zero defects manufacturing (ZDM) is the latest and most advanced approach for quality assurance. ZDM is composed of four main strategies: “Detect” and “Predict” that are the triggering ZDM strategies, and the “Repair” and “Prevent” that are the action ZDM strategies. The three ZDM pair strategies are “Detect-Repair”, “Detect-Prevent” and “Predict-Prevent”. The main difference of ZDM with the traditional quality assurance methodologies is the fact that ZDM ensures 100% of the products are inspected via any method, either detection or prediction. It is impossible to achieve ZDM if not all the products are inspected. In traditional quality improvement methods such as Six Sigma, Lean manufacturing, Lean Six Sigma, Theory of Constraints, and Total Quality Management, the analysis starts after the production has started and defects or quality issues start occurring. Modern technological advancements provided capabilities that were not possible in the past. These technological advancements initiated the emergence of another QMS method named Zero Defect Manufacturing (ZDM). One major change in ZDM is about the flow of information. Indeed, ZDM uses both historical and real-time data to prevent product from defect. Doing this, ZDM combines several quality control applications concerning production lines, machinery, automation applications, and supply chain processes. This is possible thanks to the development of IT systems and Industry 4.0. The core concept of ZDM is “Make it right at first attempt”.

Please find an overview of ZDM in [Psarommatis2020] and [Psarommatis2022a].

The objectives of the planned workshop are to define basic principles of zero defects manufacturing (ZDM), based on the terminology, which was recently created in a CEN-CENELEC Workshop and is available as CWA 17918:2022[10]. It should contain the steps on how to get to a ZDM manufacturing line and could be used by manufacturers to implement

[10] CWA 17918:2022 Zero Defects Manufacturing — Vocabulary https://www.cencenelec.eu/get-involved/research-and-innovation/cen-and-cenelec-activities/cwa-download-area/

ZDM (both on existing and new manufacturing lines). A defined set of requirements will support the manufactures to ensure following the principles of ZDM.

Further information of CWA 17918:2022 can be found in [Sousa2022] and work on an Ontology based on it in [Psarromatis2023a]. Additional information to ZDM can be found in [Psarommatis2021, Psarommatis2022b, Psarommatis2023b].

1.6 Scope

The workshop will create two CEN-CENELEC Workshop Agreements (CWA) with the proposed titles: "Zero Defects Manufacturing – Basic Principles" and "Zero Defects Manufacturing – Requirements". The WS will define the basic principles and requirements for Zero Defects Manufacturing. The ladder CWA is intended of being used as basis for conformity assessment.

The CWA Zero Defects Manufacturing – Requirements will set requirements which need to be fulfilled for manufacturers capable of implementing ZDM and producing with ZDM.

The proposed CWAs will not be management standards and will be integratable into an enterprises operating system and processes.

1.7 Related activities

The topic of the CWA is related to the following European technical committees and initiatives:

- CEN-CENELEC-ETSI Coordination Group on Smart Manufacturing (CEN-CLC-ETSI SMa-CG)
- CLC/TC 65X Industrial-process measurement, control and automation
- CEN-CLC/JTC 1 Criteria for conformity assessment bodies

On international level the following technical committees are the most relevant ones:

- IEC/TC 65/WG 23 Smart Manufacturing Framework and System Architecture
- IEC/TC 65/WG 16 Digital Factory
- IEC/SC 65E/WG 12 Predictive Maintenance
- ISO/TC 184 - Automation systems and integration
- ISO/TC 108/SC 5 Condition monitoring and diagnostics of machine systems
- ISO/TC 69 - Applications of statistical methods
- ISO/TC 176 - Quality management and quality assurance

The Workshop shall ensure appropriate links are in place with these initiatives.

The most important existing standards for the Project Plan are listed in the following table.

Number	Title
ISO 9000:2015	Quality management systems - Fundamentals and vocabulary
ISO 9001:2015	Quality management systems - Requirements
ISO 17359:2018	Condition monitoring and diagnostics of machines - General guidelines
ISO 2859-1:1999	Sampling procedures for inspection by attributes
ISO 13053-1:2011	Quantitative methods in process improvement

Number	Title
ISO 3534-2:2006	Statistics - Vocabulary and symbols - Part 2: Applied statistics
ISO 13372:2012	Condition monitoring and diagnostics of machines - Vocabulary
ISO/IEEE 11073-10201:2020	Health informatics - Device interoperability - Part 10201: Point-of-care medical device communication - Domain information model
ISO 15746-1:2015	Automation systems and integration - Integration of advanced process control and optimization capabilities for manufacturing systems - Part 1: Framework and functional model
EN ISO 10012 (under revision)	Measurement management systems - Requirements for measurement processes and measuring equipment
IEC TR 63283-5 ED1	Industrial-process measurement, control and automation – Smart manufacturing – Part 5: Market and innovation trends analysis
ISO/IEC 17000:2004	Conformity assessment – Vocabulary and general principles
ISO/IEC 17007:2009	Conformity assessment – Guidance for drafting normative documents suitable for use for conformity assessment

4 Workshop programme

1.8 General

The kick-off meeting is planned to take place on 2023-09-08. A draft for public commenting will be published for 30 days.

A total of 8 Workshop meetings (kick-off meeting and Workshop meetings) and web conferences will be held, during which the content of the CWA(s) will be presented, discussed and approved.

There will be additional meetings in sub-groups as needed to organise the paperwork.

The CWA will be drawn up in english (language of meetings, minutes, etc.). The CWA will be written in english.

1.9 Workshop schedule

Work Items

CWA Zero Defect Manufacturing – Basic Principles

04-2024 First draft

08-2024 Final draft for commenting

CWA Zero Defect Manufacturing – Requirements

06-2024 First draft

10-2024 Final draft for commenting

TABLE 3: WORKSHOP SCHEDULE (PRELIMINARY)

The project schedule is for orientation only and is to be modified as the Workshop progresses.

CEN-CENELEC Workshop Month					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	...
Initiation																								
1. Proposal form submission and TC and BT response																								
2. Project plan development																								
3. Open commenting period on draft project plan (mandatory)																								
Operation																								
4. Kick-off meeting																								
5. CWA(s) development																								
6. Open commenting period on draft CWA(s) (optional)																								
7. CWA(s) finalised and approved by Workshop participants																								
Publication																								
8. CWA(s) publication																								
Dissemination (see 7)																								
Milestones					K		V		V		V		V		V		V				V/A		P	D

B CEN/CENELEC BT meeting deciding on establishment of a CEN/CENELEC Workshop
K Kick-off
M Workshop meeting
V Virtual Workshop meeting
A Adoption of CWA
P Publication of CWA
D Online distribution of CWA

5 Resource planning

As general principle, all costs related to the participation of interested parties in the Workshop's activities have to be borne by themselves.

Registration and participation at this CEN-CENELEC Workshop are free of charge, but each participant shall bear his/her own costs for travel, accommodation, and subsistence.

The administrative costs of the CEN-CENELEC Workshop Secretariat as well as the logistical support, such as online conference tool, will be covered by ZDMP and ZDZW through its Horizon 2020 funding (grant agreement no. 825631 and 101057404). The copyright of the CWA shall be with CEN-CENELEC.

6 Workshop structure and rules of cooperation

1.10 Participation in the Workshop

The Workshop will be constituted during the course of the kick-off meeting. By approving this project plan, the interested parties declare their willingness to participate in the Workshop and will be formally named as Workshop participants, with the associated rights and duties. Participants at the kick-off meeting who do not approve the project plan are not given the status of a Workshop participant and are thus excluded from further decisions made during the kick-off meeting and from any other decisions regarding the Workshop.

As a rule, the request to participate in the Workshop is closed once it is constituted. The current Workshop participants shall decide whether any additional members will be accepted or not.

Any new participant in the Workshop at a later date is decided on by the participants making up the Workshop at that time. It is particularly important to consider these aspects:

a. expansion would be conducive to shortening the duration of the Workshop or to avoiding or averting an impending delay in the planned duration of the Workshop;
b. the expansion would not result in the Workshop taking longer to complete;
c. the new Workshop participant would not address any new or complementary issues beyond the scope defined and approved in the project plan;
d. the new Workshop participant would bring complementary expertise into the Workshop in order to incorporate the latest scientific findings and state-of-the-art knowledge;
e. the new Workshop participant would actively participate in the drafting of the manuscript by submitting concrete, not abstract, proposals and contributions;
f. the new Workshop participant would ensure wider application of the CWA.

All Workshop participants who voted for the publication of the CWA or its draft will be named as authors in the European Foreword, including the organisations which they represent. All Workshop participants who voted against the publication of the CWA, or who have abstained, will not be named in the European Foreword.

1.11 Workshop responsibilities

The Workshop Chair is responsible for content management and any decision-making and voting procedures. The Workshop Chair is supported by the Workshop Vice-Chair and the responsible Workshop secretariat, whereby the Workshop secretariat will always remain neutral regarding the content of the CWA(s). Furthermore, the Workshop secretariat shall ensure that CEN-CENELEC's rules of procedure, rules of presentation, and the principles governing the publication of CWA(s) have been observed. Should a Workshop Chair no longer be able to carry out her/his duties, the Workshop secretariat shall initiate the election of a new Workshop Chair. The list below covers the main tasks of the Workshop Chair. It is not intended to be exhaustive.

- Content related contact point for the Workshop
- Presides at Workshop meetings
- Ensures that the development of the CWA respects the principles and content of the adopted project plan
- Manages the consensus building process, decides when the Workshop participants have reached agreement on the final CWA, on the basis of the comments received
- Ensures due information exchange with the Workshop secretariat
- Represents the Workshop and its results to exterior

The Workshop secretariat, provided by a CEN/CENELEC national member, is responsible for organising and leading the kick-off meeting, in consultation with the Workshop proposer. Further Workshop meetings and/or web conferences shall be organised by the Workshop secretariat in consultation with the Workshop Chair. The list below covers the main tasks of the Workshop secretariat. It is not intended to be exhaustive.

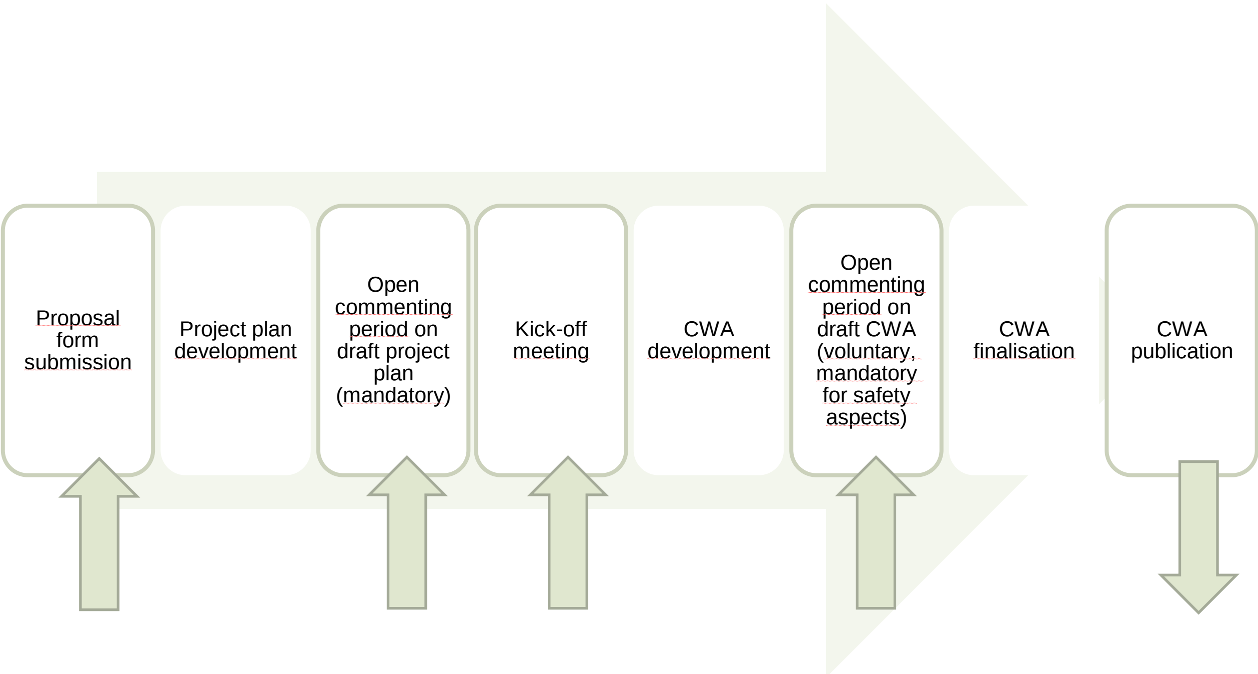
- Administrative and organisational contact point for the Workshop
- Ensures that the development of the CWA respects the principles and content of the adopted project plan and of the requirements of the CEN-CENELEC Guide 29
- Formally registers Workshop participants and maintains record of participating organisations and individuals
- Offers infrastructure and manage documents and their distribution through an electronic platform
- Prepares agenda and distribute information on meetings and meeting minutes as well as follow-up actions of the Workshop
- Initiates and manage CWA approval process upon decision by the Workshop Chair
- Interface with CEN-CENELEC Management Centre (CCMC) and Workshop Chair regarding strategic directions, problems arising, and external relationships
- Advises on CEN-CENELEC rules and bring any major problems encountered (if any) in the development of the CWA to the attention of CEN-CENELEC Management Centre (CCMC)
- Administrates the connection with relevant CEN or CENELEC/TCs

1.12 Decision making process

Each Workshop participant is entitled to vote and has one vote. If an organisation sends several experts to the Workshop, that organisation has only one vote, regardless of how many Workshop participants it sends. Transferring voting rights to other Workshop participants is not permitted. During voting procedures, decisions are passed by simple majority; abstentions do not count.

If Workshop participants cannot be present in the meetings when the CWA or its draft is adopted, an alternative means of including them in the voting procedure shall be used.

7 Dissemination and participation strategy



Proposal form submission
The Workshop proposal was disseminated to the following relevant stakeholders and bodies for consultation:

- CLC/TC 65X Industrial-process measurement, control and automation
- CEN-CLC/JTC 1 Criteria for conformity assessment bodies

And to the coordination group for information:

- CEN-CENELEC-ETSI Coordination Group on Smart Manufacturing (CEN-CLC-ETSI SMa-CG)

Open commenting period on draft project plan
The project plan will be disseminated to the following relevant stakeholders and bodies for commenting:

- CLC/TC 65X Industrial-process measurement, control and automation
- CEN-CENELEC-ETSI Coordination Group on Smart Manufacturing (CEN-CLC-ETSI SMa-CG)
- IEC/TC 65/WG 23 Smart Manufacturing Framework and System Architecture

- IEC/TC 65/WG 16 Digital Factory
- IEC/SC 65E/WG 12 Predictive Maintenance
- ISO/TC 184 - Automation systems and integration
- ISO/TC 108/SC 5 Condition monitoring and diagnostics of machine systems

In addition to the CCMC website, the project plan and the date of the kick-off meeting will be advertised within the ZDM cluster of European Horizon ZDM projects to raise awareness. Interested parties are requested to contribute either through commenting of the project plan (short term) or through Workshop participation (long term).

Open commenting period on draft CWA
The draft CWA will be disseminated to the following relevant stakeholders and bodies for commenting:

- CLC/TC 65X Industrial-process measurement, control and automation
- CEN-CENELEC-ETSI Coordination Group on Smart Manufacturing (CEN-CLC-ETSI SMa-CG)
- IEC/TC 65/WG 23 Smart Manufacturing Framework and System Architecture
- IEC/TC 65/WG 16 Digital Factory
- IEC/SC 65E/WG 12 Predictive Maintenance
- ISO/TC 184 - Automation systems and integration
- ISO/TC 108/SC 5 Condition monitoring and diagnostics of machine systems

In addition to the CCMC website, the draft CWA will be advertised within the ZDM cluster of European Horizon ZDM projects to raise awareness. Interested parties are requested to contribute through commenting of the draft CWA (short term).

CWA publication
The final CWA will be disseminated to the following relevant stakeholders and bodies:

- CLC/TC 65X Industrial-process measurement, control and automation
- CEN-CENELEC-ETSI Coordination Group on Smart Manufacturing (CEN-CLC-ETSI SMa-CG)
- IEC/TC 65/WG 23 Smart Manufacturing Framework and System Architecture
- IEC/TC 65/WG 16 Digital Factory
- IEC/SC 65E/WG 12 Predictive Maintenance
- ISO/TC 184 - Automation systems and integration
- ISO/TC 108/SC 5 Condition monitoring and diagnostics of machine systems
- ZDM Horizon project Cluster

In addition to the CCMC website, the final CWA will be advertised on:

- social media, such as
    - LinkedIn
- Other relevant channels

8 Contacts

- Workshop Chair (proposed):

  Foivos Psarommatis Giannakopoulos
  Univeristy of Oslo/ Universitat Politècnica de València

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foivosp@ifi.uio.no
http://www.ifi.uio.no/

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<name>
<Organisation>
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9 ANNEX – SURVEY

HOW WOULD YOU RATE YOUR KNOWLEDGE ABOUT STANDARDIZATION? (1 IS LOW, 3 IS EXPERT)	HAVE YOU EVER BEEN OR ARE YOU CURRENTLY ACTIVE IN A STANDARDIZATION COMMITEE OR OTHER ORGANIZATION THAT DEVELOPS STANDARDIZATION DOCUMENTS?	HAVE YOU EVER PARTICIPATED IN THE DEVELOPMENT OF A PRE-STANDARDIZATION DOCUMENT SUCH AS A CWA (CEN WORKSHOP AGREEMENT) OR A CONSORTIUM STANDARD?	IF YES, PLEASE NAME THE DOCUMENT/WORKSHOP.	WHICH STANDARDS DO YOU ALREADY KNOW WITHIN YOUR ACTIVITIES IN ZDZW AND FOR WHICH TASKS OR COMPONENTS WILL YOU USE THEM?	WHAT ARE THE RELEVANT FIELDS IN WHICH YOU WOULD LIKE TO GET AN OVERVIEW OF THE STANDARDIZATION LANDSCAPE? PLEASE NAME ALL RELEVANT KEYWORDS, WHICH WILL THEN BE USED IN OUR RESEARCH.
1	No	No		None	Life-cycle
1	No	No		None	Artificial intelligence
2	No	Yes	Richtlinie VDI 3405 - Gestaltungsempfehlungen für die additive Fertigung keramischer Bauteile	DIN EN 843-1:2008	additive manufacturing, ceramics
1	No	No			No particular fields.
2	No	No		ISO standards (ISO 3834, ISO 15614-1/7, ISO 9606-1/-2, ISO 17636-1/2, ISO 17638, ISO 17640, ISO 17637, ... Painting, NDT& Welding related standards).	welding , ndt, painting, monitoring
1	No	No		None	Zero Defects Defect Trend Defect Prediction Defect Classification
1	No	No		None	pulsed lasers

2	No	No		ISO 9001 Quality and ISO 27001 Information Security for WP7	Our organisation has been certified of compliance with ISO 9001:2015/ ISO 14001:2015/ ISO 45001:2018 and ISO 27001. We are interested in understanding other standardisation on digitalisation platform, data management and data protection, process for lowering carbon footprint.
2	No	Yes	ZDZW Standardization Workshop	ISO 14040:2006 and ISO 14044:2006 for conducting Life Cycle Analysis to quantify the environmental impacts in the project for respective Pilots.	Sustainability, Life Cycle Analysis, Life Cycle Cost Analysis
2	No	Yes	as part of the ZDMP project / activity's lead by DIN	OpenAPI Specification (see https://de.wikipedia.org/wiki/OpenAPI)	manufacturing IoT
1	No	No		I do not know yet.	Thermoforming, thermal camera
1	No	No		I don't know anything about standarization	Standards in inspection technologies, which ones can be applied to zero defects manufacturing, and how to implement those standards in industry.
1	No	No		None	Optics, Photonics, Lasers, Optical Coherence Tomography
1	No				Deffect trend Deffect detection
1	No	No		Not applicable	Not applicable
1	No	No		We have no experience with standards	Non-contact, non-destructive optical scanners
2	No	No			
1	No	No			Computer Vision

1	No	No		There is a standard that indicates de required %Martensite in the centre of the bolt (Task 4.1), but I don't know which is the standard. I think that it is a ISO standard.	Material or component requirements for wind turbine applications.

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CHANGE LOG

VERSION	DESCRIPTION OF CHANGE
V0.1	First draft reviewed by Oscar
V0.2	Implementation of recommendations, to be reviewed by Arturo and Foivos
V0.3	Implementation of recommendations from reviewers
V1.0	Submitted version