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Development of Competency Standard for Creating Environmental Product Declarations (EPD) to Enhance Brand Reputation

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Abstract

The development of competency standards for creating Environmental Product Declarations (EPDs) is crucial for enhancing brand reputation by ensuring accurate, reliable, and internationally compliant environmental reporting. This study aims to systematically develop and validate these standards to support sustainable business practices, employing a qualitative approach using the Gall and Borg model and the Regional Model Competency Standards (RMCS) framework. The research clarifies development requirements, confirms systems and regulations, identifies potential issues, explores relevant data, and formulates and validates competency units. The results highlight a comprehensive process that emphasizes the application of sustainability principles, appropriate use of technology, and collaboration with stakeholders to ensure transparency and accuracy in environmental impact reporting. Additionally, the study developed a model illustrating the alignment of competency standards with industry SOPs, curriculum, and modules, effectively structuring competency development. The study concludes that companies implementing these standards can produce better and more transparent EPDs, critical for building consumer trust and loyalty. By aligning industry needs with educational outcomes, the standards bridge the gap between theoretical knowledge and practical application, demonstrating a commitment to sustainability and significantly enhancing brand reputation.

Keywords: Environmental Product Declarations (EPD), Competency Standards, Brand Reputation, Sustainability, Environmental Responsibility.

INTRODUCTION

In the modern industrial age, awareness of sustainability and environmental responsibility is increasing. Consumers are now more concerned about the environmental impact of the products they use and tend to choose products manufactured with environmentally friendly practices. This has encouraged companies to be more transparent in reporting the environmental impact of their products, one of which is through Environmental Product Declarations (EPD).

An Environmental Product Declaration (EPD) is a document that provides measurable and verified environmental data about the environmental impact of a product. EPDs are crucial because they offer transparency to consumers regarding the environmental impact of the products they use. According to Rangelov et al., (2021), EPDs report multiple environmental impacts reflective of a supply chain, calculated using the Life Cycle Assessment (LCA) method per predefined rules known as Product Category Rules (PCRs) (ISO, 2006), and are third-party verified (ISO, 2006). Rondinel-Oviedo & Keena, (2022) also emphasize that an EPD, as the final report of an LCA, provides a comprehensive description of the environmental characteristics of a material and is verified by a third party for validity. Furthermore, Gelowitz & McArthur, (2017) assert that EPDs are third-party verified product data sheets developed based on the requirements of ISO 14025.

Developing competency standards in drafting Environmental Product Declarations (EPDs) is essential to ensure that the documents are accurate, reliable, and compliant with international standards. Levis et al., (2020) emphasizes the importance of developing these standards to maintain the integrity and validity of the EPDs. Sumitra Shrestha et al., (2016) mention that developing reliable and valid versions of screening instruments, such as the EPDS, is crucial for ensuring accurate and reliable detection of perinatal common mental disorders (PCMDs) in various cultural contexts. Similarly, Hasanbeigi & Shi, (2021) identify that EPDs are designed to enhance transparency regarding a product's environmental impact by detailing the environmental impacts associated with the product's life cycle without comparing it to alternative products. Thus, the establishment of competency standards is fundamental to achieving the accuracy and reliability necessary for effective environmental reporting.

Brand reputation is significantly influenced by how a company manages its environmental responsibility. Companies that demonstrate their commitment to sustainability through transparent Environmental Product Declarations (EPDs) tend to have a better reputation in the eyes of consumers. Tran & Adomako, (2022) state that brand reputation is heavily influenced by a company's management of environmental responsibility, and companies that demonstrate their commitment to sustainability through transparent EPDs tend to enjoy a better reputation among consumers. Jančiauskaitė et al., (2019) identifies that corporate sustainability is crucial for the future of a company if it aims to meet stakeholders' needs and ensure equity for future generations. Adomako, (2020) mentions that firms engaging in environmental collaboration and sustainable innovation tend to enhance their brand reputation and achieve better market gains. Additionally, Loureiro et al., (2017) found that companies prioritizing environmental and social responsibility tend to enhance their brand reputation and achieve greater customer loyalty.

The lack of clear competency standards in drafting Environmental Product Declarations (EPDs) can result in inaccurate or incomplete information, which in turn can damage the reputation of the brand. Andersen et al., (2019) identifies that despite a common desire to build sustainably, EPDs and Life Cycle Assessments (LCAs) are often interpreted differently, leading to

misunderstandings regarding their use in quantifying and verifying sustainability. Hasanbeigi & Shi, (2021) found that EPDs can vary in scope, making them difficult to compare with one another. Mazurek, (2019) emphasizes that without clear and standardized competency guidelines, the accuracy and completeness of EPDs can be compromised, potentially harming the brand's reputation.

This research raises several key questions: What are the key competencies required to develop an effective EPD? How can the development of competency standards improve the quality of EPD? And, how can a quality EPD affect brand reputation? The objectives of this research include identifying the key competencies required in drafting the EPD, developing competency standards for EPD preparation, and evaluating the impact of EPD on brand reputation.

RESEARCH METHODS

This study employed a qualitative approach with a descriptive research design. The methodology was enriched by incorporating the Gall and Borg model as well as the RMCS (Regional Model Competency Standards) (Gall, M., Gall, J., Borg, 2015; ILO, 2016). The Gall and Borg model is a well-established framework for conducting educational research and developing educational programs. This model involves a systematic process of research and development, including the following steps:

1. Identification of Needs: Assessing the specific needs of the target population.
2. Literature Review: Conducting a thorough review of existing literature to inform the development process.
3. Planning and Development: Designing the research plan and developing the necessary instruments for data collection.
4. Data Collection: Gathering data through various means such as surveys, interviews, and observations.
5. Data Analysis: Analyzing the collected data to identify patterns and insights.
6. Evaluation and Revision: Evaluating the findings and making necessary revisions to improve the research outcomes.

In this study, the Gall and Borg model was used to systematically develop and refine the competency standards for drafting Environmental Product Declarations (EPDs). The RMCS framework was integrated into the methodology to ensure that the competency standards developed are relevant and applicable across different regions. The RMCS provides a structured approach to defining the skills, knowledge, and abilities required for specific roles and ensures that these standards are aligned with regional industry needs. The steps involved in the RMCS approach include:

1. Stakeholder Consultation: Engaging with industry experts, educators, and other stakeholders to gather input on the necessary competencies.

2. Competency Mapping: Identifying and mapping the key competencies required for drafting EPDs.
3. Validation: Validating the identified competencies through feedback from stakeholders and experts.
4. Standardization: Standardizing the competencies to ensure consistency and applicability across different regions.

Data Collection

Data was collected through literature analysis and in-depth interviews with experts in the fields of environment and marketing. The literature analysis involved a comprehensive review of existing research on EPDs, competency standards, and brand reputation. In-depth interviews were conducted with industry experts to gather qualitative insights and validate the findings from the literature review.

Data Analysis

The collected data was analyzed using thematic analysis techniques to identify key patterns and themes related to the development of competency standards for EPDs. The findings from the data analysis were used to refine the competency standards and ensure their relevance and applicability.

By integrating the Gall and Borg model and the RMCS framework, this study provides a robust methodology for developing competency standards that are accurate, reliable, and aligned with international and regional standards. This approach ensures that the developed standards are comprehensive and applicable across different contexts, ultimately enhancing the effectiveness and credibility of EPDs.

RESULTS AND DISCUSSION

Results

Based on the methods and design steps of this research, the results of each standard development step can be presented as follows. These results encompass the formulation, validation, and assessment processes to ensure comprehensive and reliable competency standards for developing an Environmental Product Declaration (EPD). Each step's outcomes are detailed to reflect the systematic approach undertaken to achieve the research objectives.

Clarification of competency standard development requirements: To clarify the scope and objectives of developing competency standards with stakeholders, the scope includes the job area of Green Productivity, covering cross-sector business or industry areas, but not limited to any specific community or profession. The regulator involved is the Directorate of Productivity-Indonesia. The objectives of developing this standard are to establish performance requirements, set comparative references for learning, establish regulatory or licensing requirements, determine entry requirements for an occupation or profession, provide a basis for maintaining competence in a given occupation or profession, and support the achievement of business objectives, strategy,

human resource, or organizational development. Stakeholder clarifications involve the Ministry/Institution, specifically the Directorate of Productivity-Indonesia, the manufacturing industry, and professional organizations such as educational and training institutions.

Confirmation of the system, processes, and technical regulations for the development of competency standards has been established with the relevant personnel. The system used is the National Work Competency Standardization System. The process follows SKKNI 333-2020, and the regulation adhered to is MoL 03/2016 (Permenaker 333, 2020).

Potential issues have been identified for suitability and relevance, particularly regarding how the industry can declare their green product implementation. Exploring data and information involves collecting relevant data and information based on established methods and instruments. This includes gathering primary data standard requirements and secondary data standard requirements. The collection should ensure that the data and information are suitable in terms of type, quality, and adequacy, encompassing a competency map, an occupation map within the qualification framework, a description of the KKNI, the scope of employability skills, main duties and functions of job positions in the industry, and standard operating procedures for the industry.

The next step is to analyze the processed data and information to formulate competency standards. This analysis includes examining data on occupations, competency units, and the main steps of the process. This structured approach ensures that the competency standards are comprehensive, relevant, and aligned with industry needs and requirements.

The formulation of a competency unit begins with determining the title of the competency unit based on its basic function. The description of the competency unit is outlined by the scope, which corresponds to the title of the competency unit. The competency elements are identified based on the consistency and traceability of the work process, ensuring they align with the work's requirements.

Performance criteria are established by considering the content of skills, knowledge, and work attitudes in the sequence of competency elements. Employability skills are determined according to the context in the KUK. Assessment guidelines are formulated based on their relevance to workplace conditions, and critical aspects are identified based on measures and KUK that significantly impact the unit's outcome.

The results of the formulation of competency standards in accordance with the RMCS Model are presented as follows:

Table 1. Competency Standard of Developing An Environmental Product Declaration (EPD)

Unit Title : Developing An Environmental Product Declaration (EPD)
Unit Description : This unit includes the ability to develop, document, and publish an Environmental Product Declaration (EPD) which is a communication tool that provides

	quantitative and transparent information about the environmental impact of products. EPD aims to provide objective and comparable data on the environmental performance of products. The main principles of this unit are transparency, accuracy and reliability in reporting environmental data, in accordance with accepted international standards for life cycle assessment and environmental reporting of products.	
1.	**Element 1: Collecting Data**	
	Perfomance Creteria	**Cotext of variabel**
1.1.	**The principles of sustainability** are identified in accordance with applicable regulations.	**Sustainability principles**, may include: • Application of international sustainability standards. • Commitment to environmental responsibility. • Transparency in environmental impact reporting.
1.2.	**Data on material inputs, energy use, and emissions during the product life cycle** are collected according to the life cycle assessment methodology (LCA).	**Data on material inputs, energy use, and emissions during the product life cycle**, may include: • Data collection according to LCA methodology. • Evaluation of environmental impacts from extraction to disposal. • Measurement of energy use and emissions.
1.3.	**Data sources** are verified to ensure accuracy and relevance to the product under review.	**Data sources verification**, may include: • Verify the data source for accuracy. • The relevance of the data to the product under review. • Compile data according to relevant standards.
1.4.	**All data necessary for the completion of the EPD** are compiled according to the relevant standard framework.	**All data necessary for the completion of the EPD**, may include: • Complete and accurate data collection. • Compliance with the standard framework. • Verify and validate data before use.
1.5.	**LCA software technology and data collection tools** are used for life cycle analysis and compiling EPDs.	**LCA software technology and data collection tools**, may include: • Use of LCA software. • Tools for accurate data collection.

		• Technology for life cycle analysis.
2.	**Element 2. Perform a Life Cycle Analysis**	
	Perfomance Creteria	**Cotext of variabel**
2.1.	**LCA results** are interpreted to identify critical areas of environmental impact.	**LCA results**, may include: • Interpretation of LCA results. Identify critical areas of environmental impact. • Reporting of results in EPD.
2.2.	**The limitations of the LCA analysis** are stated in the EPD document.	**The limitations of the LCA analysis**, may include: • Statement of limitations of the LCA methodology. • Transparency regarding analysis limitations. • Clear information in the EPD document.
2.3.	**Corrections** are made based on feedback from the verification process.	**Corrections**, may include: • Corrections based on verification feedback. • Customization to meet quality standards. • EPD revision for accuracy and reliability.
3.	**Element 3. Preparing EPD**	
	Perfomance Creteria	**Cotext of variabel**
3.1.	**Information on the environmental impact of the product** is summarized in EPD format according to the ISO 14025 standard.	**Information on the environmental impact of the product**, may include: • Summary of the environmental impact of the product. • EPD format complies with ISO 14025 standard. • Transparency in impact reporting.
3.2.	**Environmental impact measurement and methodology** are described in detail to ensure transparency.	**Environmental impact measurement and methodology**, may include: • Environmental impact measurement. • Description of the methodology used. • Transparency in measurement methods.
3.3.	**EPDs** are reviewed by an independent third party for validation prior to issuance.	**EPDs**, may include: • Validation by independent third parties. • EPD publications comply with international standards. • Accessibility for stakeholders.

3.4.	**Environmental impact measurements and methodologies** are communicated in detail to ensure transparency.	**Environmental impact measurements and methodologies**, may include: • Measurement to ISO 14025 standard. • Accurate and reliable methodology. • Compliance with international standards.
4.	**Element 4. Perform Verification and Validation**	
	Perfomance Creteria	**Cotext of variabel**
4.1.	**The EPD process** is verified out by a recognized verification body to ensure the credibility of the report.	**The EPD verification process**, may include: • Verification by a recognized body. • Correction based on feedback. • Certificate verification as valid documentation.
4.2.	**Corrections** are made based on feedback from the verification process.	**Corrections**, may include: • Based on Verification Feedback • Quality Adjustment • Document Revision
4.3.	**The verification certificate** is issued as part of valid EPD documentation.	**The verification certificate**, may include: • Valid Documentation • Proof of Credibility • Compliance with Standards
4.4.	**Collaboration** is carried out with various stakeholders.	**Collaboration**, may include: • Verify data sources with various parties. • Collaboration with independent bodies. • Work together to ensure data accuracy.
5.	**Element 5. Publishing and Communication**	
	Perfomance Creteria	**Cotext of variabel**
5.1.	EPDs are published openly on appropriate platforms to provide easy access for stakeholders.	-
5.2.	**Information in EPDs** is conveyed to customers and stakeholders through marketing and communication materials.	**Information in EPDs**, may include: • Clear delivery of information. • Marketing and communication materials. • Collection of feedback from stakeholders.
5.3.	**Feedback from stakeholders** is collected to improve the EPD process in the future.	**Feedback from stakeholders**, may include: • Collection of feedback from stakeholders. • EPD process improvement based on feedback.

		• Stakeholder satisfaction with EPD. Collection of feedback from stakeholders. • EPD process improvement based on feedback. • Stakeholder satisfaction with EPD.
6.	**Element 6. Performing Updates and Maintenance**	
	Perfomance Creteria	**Cotext of variabel**
6.1.	EPDs are reviewed and updated regularly to reflect changes in production processes or applicable standards.	-
6.2.	**Update data** is monitored to ensure the continued accuracy of EPD information.	**Update data**, may include: • Regular data updates. • Certainty of EPD information accuracy. • Reflection of changes in the production process.
6.3.	**Important changes in the product or production process** are reported in the revised EPD.	**Important changes in the product or production process**, may include: • Reporting of important changes in EPD. • Update information to reflect current conditions. • Transparency to changes in production processes.

ASSESSMENT GUIDE:

Assessment Context: Assessment through document review, case analysis, and EPD presentation that has been developed by participants.

Competency Requirements: In-depth understanding of LCA principles, analytical ability in data assessment, and skills in environmental report preparation.

Required Knowledge and Skills: Expertise in LCA methodology, knowledge of EPD standards, skills in data management and effective communication.

Required Work Attitude: Thoroughness, integrity in reporting data, proactivity in updating and maintaining EPDs, and openness to feedback.

Critical Aspects: Accuracy and precision of data in EPDs, reliability of verification results, and effectiveness of communication about the environmental impact of products to the public and stakeholders.

Validation: The method of validating competency standards is determined by considering their characteristics and the available resources, which include Focus Group Discussions (FGD),

public trials, pre-conventions, and conventions. These methods ensure the thorough validation of the competency standards.

Based on the results of the competency standard pre-convention led by the author in Batam on 13 June 2024, which involved representatives from industry, educational institutions, training institutions, and government elements, there was a unanimous agreement on the importance of this standard. In addition to protecting the environment and enhancing productivity, the standard is expected to significantly bolster the industry's reputation in marketing its products.

Once the validation methods are determined, instruments for process conformity are based on the Standards Development Principles and the RMCS validation questionnaire, while customization instruments are based on the technical substance. The validation of competency standards is conducted to ensure they meet the required competency standard requirements. The results of the validation are then documented in accordance with applicable regulations.

Discussion

The study successfully formulated competency standards for creating Environmental Product Declarations (EPDs) aimed at enhancing brand reputation. The developed competency standards cover several key elements organized into different categories. The formulated standard can be illustrated as follows.

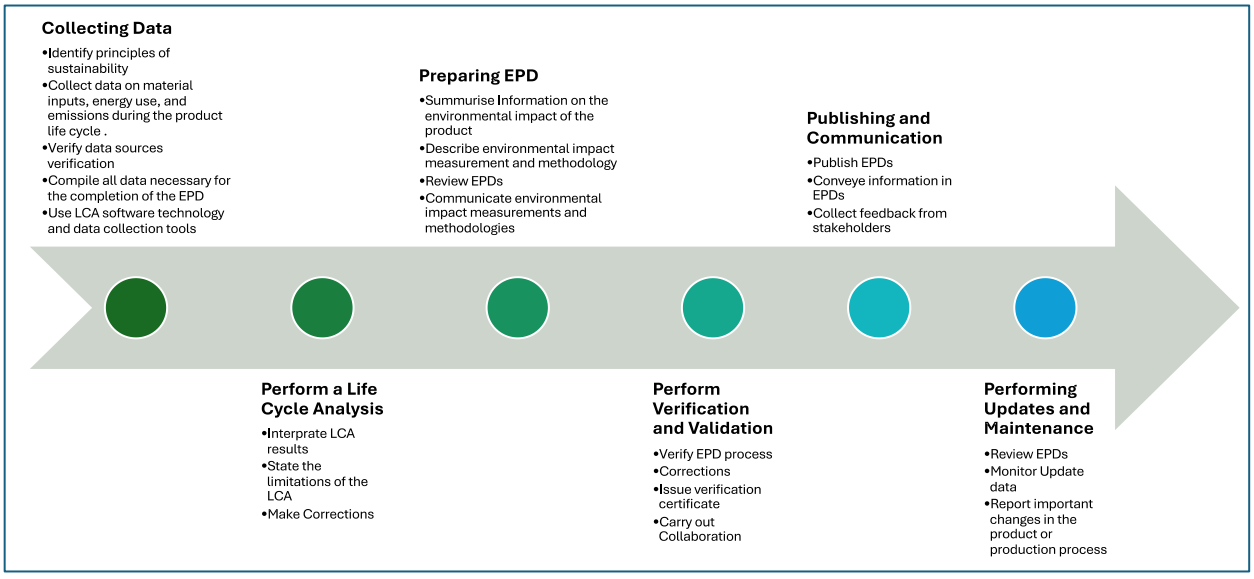

Figure 1. Developing An Environmental Product Declaration (EPD)

Data Collection

Initially, sustainability principles were prioritized by applying international sustainability standards to ensure the company's commitment to environmental responsibility and transparency in reporting environmental impacts. Subsequently, data on material inputs, energy use, and

emissions were meticulously gathered using the life cycle assessment (LCA) methodology. This method assesses the environmental impact of a product throughout its entire lifecycle, from raw material extraction to disposal. To guarantee the accuracy and relevance of this data, sources were rigorously verified, and all necessary data for the Environmental Product Declaration (EPD) were compiled and validated against relevant standards. Additionally, the use of advanced LCA technology was emphasized, incorporating LCA software and data collection tools to enhance the precision and efficiency of the life cycle analysis and EPD preparation. Broyles et al., (2024) highlights how these datasets are critical for evaluating the environmental impacts of various concrete mixtures, thereby improving sustainability in construction practicesTaherdoost, (2021) discusses the significance of choosing appropriate data collection techniques and their impact on the reliability and validity of research outcomes, underscoring the critical role of method selection. Similarly, Del Rosario et al., (2021) stresses the importance of systematic data collection and analysis in advancing sustainability goals across various sectors.

Conducting Life Cycle Analysis

The results of the Life Cycle Assessment (LCA) were analyzed to pinpoint critical areas of environmental impact, which were then documented in the Environmental Product Declaration (EPD). The EPD also clearly outlined the limitations of the LCA methodology to enhance transparency concerning the analysis boundaries. Furthermore, based on feedback received during the verification process, necessary corrections were made to ensure that the EPD met established standards for quality and accuracy. Meili & Jungbluth, (2019) emphasize the crucial role of LCA in EPD development, noting its importance for providing precise and practical guidelines as well as user-friendly Life Cycle Impact Assessment (LCIA) methods. Soust-Verdaguer et al., (2023) underscores that EPDs, by offering validated and geographically representative data, are essential for accurately assessing the embodied impacts of buildings, thus highlighting the importance of conducting comprehensive LCAs for reliable EPD development. Barahmand & Eikeland, (2022) discusses how life cycle assessment methodologies are integral to understanding and mitigating the environmental impacts of infrastructure projects, reinforcing the need for thorough LCAs to create EPDs that are meaningful and contribute effectively to global sustainability efforts.

Preparing EPDs

Information regarding the environmental impact of the product was succinctly summarized in accordance with ISO 14025 standards, with detailed descriptions of the methodology included to ensure transparency. Additionally, EPDs underwent a review by independent third parties for validation prior to publication, which ensured compliance with international standards. Milena Rangelov (2020) emphasizes that meticulous preparation is essential for the reliable development and implementation of EPDs. Martin-Delgado et al., (2022) highlights how this preparation permits early adjustments in material composition, thereby enhancing the environmental performance of the final product. Arellano-Vazquez et al., (2020) outlines the structured process

of EPD preparation, which is crucial for transparent communication about the environmental impacts of products, aiding stakeholders in making informed decisions based on standardized environmental information.

Verification and Validation

The verification process was rigorously conducted by recognized bodies to ensure the credibility of the report. Verification certificates were obtained as tangible proof that the EPD met all required standards. Additionally, collaboration with various stakeholders was essential to verify data sources and confirm the accuracy and relevance of the data used in the EPD. M. Altaie et al., (2020) highlights the critical role of Verification and Validation (V&V) in software development, underscoring their importance in ensuring that the software fulfills user requirements and specifications. Similarly, Martin-Delgado et al., (2022) asserts that thorough verification and validation processes significantly enhance the robustness and reliability of the EPD.

Publishing and Communication

EPDs were made readily accessible by being openly published on appropriate platforms, facilitating easy stakeholder access. The information within these documents was clearly articulated through marketing and communication materials, and stakeholder feedback was actively solicited to refine the EPD process for future iterations. Odoom, (2020) emphasizes the critical need for stakeholders to understand and utilize the information provided, thereby underscoring the vital role of effective communication in the development and application of EPDs. Similarly, Melkote, (2018) points out the indispensable role of media and communication in driving social change and development, highlighting its importance in the environmental sector.

Updating and Maintenance

Data was consistently updated to ensure that the Environmental Product Declaration (EPD) remained accurate and reflective of any changes in production processes or applicable standards. Significant modifications in the product or production methods were duly reported in the updated EPDs to maintain transparency and relevance. Del Rosario et al., (2021) underscores the necessity of ongoing updates and diligent maintenance of EPDs to keep them aligned with the latest environmental standards and industry practices. Artuso & Palladino, (2019) highlights the importance of continually updating knowledge and methodologies to remain relevant and accurate in any evaluative process. Similarly, Arellano-Vazquez et al., (2020) asserts that in sustainability practices, the continuous updating and maintenance of documents like EPDs are crucial for accurately representing environmental impacts as processes and standards evolve over time.

The findings of the study highlight the critical role of formulating competency standards in creating Environmental Product Declarations (EPDs) that are accurate, reliable, and compliant with international standards. Key to this process are the application of sustainability principles, the adept use of technology, and collaboration with various stakeholders. Additionally, regular updates of data and feedback from stakeholders are essential in enhancing the quality and

reliability of EPDs. Del Rosario et al., (2021) underscores the importance of competency standards in ensuring that EPDs accurately reflect environmental impacts in line with current methodologies and compliance requirements. Artuso & Palladino, (2019) points out that rigorous standards and formalized processes are crucial for the reliability and compliance of EPDs with broader environmental assessment criteria. Arellano-Vazquez et al., (2020) adds that comprehensive and accurate sustainability reports, including EPDs, must align with international guidelines to foster stakeholder trust and enhance corporate reputation.

The successful formulation of competency standards proves that companies capable of implementing these standards can produce better and more transparent Environmental Product Declarations (EPDs), subsequently enhancing their brand reputation among consumers and stakeholders. By adhering to established procedures and standards, companies demonstrate their commitment to sustainability and environmental responsibility—key factors in building consumer trust and loyalty. Ghuslan et al., (2021) emphasizes the significance of effective corporate governance, closely linked to competency standards, in improving the quality of environmental and social reporting. Similarly, Pedrini & Ferri, (2019) suggest that integrating environmental and social governance criteria, akin to competency standards, into corporate strategies not only enhances the reliability and transparency of environmental reports, including EPDs but also aligns business operations with international standards, thereby improving stakeholder trust and corporate reputation.

Based on the model interface of Industry SOPs, Competency Standards, Curriculum and Modules, and certification schemes described by Surono et al., (2020), the study revealed that the development of competency standards can be effectively traced back to Industry SOPs and/or the curriculum and modules developed by educational and training institutions. This connection and alignment among these three critical areas are illustrated below.

Table 2. Link and Match of Competency Standards with Industry SOPs, Curriculum, and Modules

Industry SOPs →	**Competency Standard** ←	**Curriculum and module**
Tittle of SOP	Tittle of Unit of Competency	Topic of Learning/ Instructional Goal
Scope	Description	Scope
Major step of procedures	Elements	Sub topic/ Learning objectives/ learning experience
Work Instruction	Performance Criteria	Indicator of competency
Context of specific product	Variable context	Learning context variable

Quality Assurance guide	Assessmen Guide	Assessment Guide

According to the table that links and matches competency standard development with industry SOPs, as well as curriculum and modules, the development of competencies can be effectively structured using these sources. This method not only enhances productivity in standard formulation but also ensures a robust alignment between industry needs and educational outcomes. Wijngaards-de Meij & Merx, (2018) underscores the critical importance of a clear and aligned approach to achieve educational goals, which, in the context of EPDs, translates to meeting both industry and environmental standards. Surono et al., (2020) further highlight how structured alignment between educational outcomes and industry requirements can enhance the formulation of competency standards, supporting the idea that well-developed standards lead to more effective and compliant EPDs. Pak et al., (2020) and Valiente Bermejo et al., (2022) argue that the continuous adaptation and alignment of competency standards, in response to evolving educational and industry demands, are essential for maintaining the relevance and effectiveness of EPDs.

CONCLUSION

The study has successfully formulated competency standards for creating Environmental Product Declarations (EPDs) aimed at enhancing brand reputation. These competency standards cover key elements organized into different categories, ensuring a comprehensive approach to developing EPDs that meet international standards. The systematic process involved clarifying development requirements, confirming systems and regulations, identifying potential issues, exploring relevant data, formulating competency units, and validating the standards.

The study has successfully formulated a model of Link and Match of Competency Standards with Industry SOPs, Curriculum, and Modules. Each component of competency unit was meticulously executed to ensure a precise alignment with industry needs and educational outcomes. This involved continuous collaboration with industry stakeholders to understand their specific requirements and expectations, ensuring that the competency standards were not only theoretically sound but also practically applicable. The detailed processes incorporated feedback loops where industry experts provided insights and validated the relevance of each competency element. Additionally, educational institutions were engaged to align the competency standards with current curricula and training modules, ensuring that the learning outcomes were directly linked to the skills and knowledge required by the industry. This comprehensive approach ensured that the competency standards were robust, relevant, and effectively bridged the gap between educational training and industry demands.

The formulated competency standards are crucial for ensuring the accuracy, reliability, and compliance of EPDs with international standards. By adhering to sustainability principles, utilizing

appropriate technology, and collaborating with stakeholders, companies can produce transparent and high-quality EPDs. This, in turn, enhances their brand reputation, demonstrating a commitment to environmental responsibility and sustainability. The interface between Industry SOP, Competency Standards, and Curriculum and Modules ensures that the developed competencies are relevant and effectively meet both industry requirements and educational goals.

Further studies could examine the long-term impact of implementing these competency standards on brand reputation and environmental performance. Additionally, research into the continuous improvement of EPD processes based on stakeholder feedback and technological advancements would be beneficial to keep the standards current and effective.

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