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Zero Waste Certification as a Sustainability Assessment Tool for SMEs- Focusing on Comparison of Certification Systems in Each Country

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ABSTRACT: There are various efforts to reduce carbon and circulate resources around the world. Among them, the zero waste movement and related eco-friendly products are growing in terms of minimizing waste. In this context, various countries are operating the zero waste certification as a way to prove the sustainability of these products and services. This study compares zero waste certification in Korea, Japan, and the U.S., and as a result, improves the certification system and applies it to a practical case. This study aims to develop and advance the Korean zero waste certification as a zero waste evaluation tool by suggesting ways to improve the Korean zero waste certification

KEYWORDS: Zero waste, Waste, Certification, Sustainability, Revision

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1. INTRODUCTION

1.1 Background and objective

Global awareness of climate change and the environment has led to a proliferation of activities to reduce carbon emissions, a major contributor to global warming, and to achieve the Sustainable Development Goals.

UN Sustainable Development Goal 12, which the 70th UN General Assembly resolved to achieve by 2030 in 2015, emphasizes responsible consumption and production. Target 12.5, "By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse," calls for countries to work towards reducing waste generation by both industries and individuals, particularly by encouraging recycling and reuse of waste in industrial processes and consumption, reducing excessive packaging of products, and introducing environmentally friendly products. [1]

Furthermore, the United Nations Environment Programme (UNEP) has called for efforts to reduce waste, including redesigning products and packaging, promoting consumer awareness, and encouraging producer responsibility for waste.

In April 2024, the European Parliament finalized an agreement on the Packaging and Packaging Waste Regulation (PPWR) to promote the reduction and recycling of packaging waste. This is a significant step up from the existing Directives to the level of legislation.[2] Also, In Japan, the Plastic Resource Circulation Promotion Act) (プラスチック資源循環促進法), based on the 3Rs (Reduce, Reuse, Recycle) + Renewable, has been in effect since 2022.[3]

In order to reduce waste, which is one of the problems of the climate crisis, the world is making various efforts to create common goals and enforce regulations and laws in each country.

In this regard, the study focuses on zero waste, an effort that started with individuals and expanded to industry and national levels to reduce waste.

According to the Zero Waste International Alliance's definition of zero waste, zero waste is the conservation of all resources by means of responsible production, consumption, reuse, and recovery of products, packaging, and materials without burning and with no discharges to land, water, or air that threaten the environment or human health.[4] Zero waste efforts have spread globally since 2009, when Bea Jhonson's blog and book THE ZERO

WASTE HOME, featuring her zero waste practices, was published.

The 5Rs are the five principles of zero waste: Refuse, Reduce, Reuse, Recycle, and Rot. Reuse is broadly defined to include reforming, upcycling, and repurposing items beyond their original purpose, while the concept of "5R+α (alpha)" has been proposed and expanded to include repair, which can extend the life of a product and reduce overall plastic consumption, and replace plastic products with environmentally friendly materials. [5]

Many companies have developed products and services that incorporate zero waste practices, and the number of zero waste shops selling environmentally friendly products has expanded to about 150 in Seoul, Korea by 2022.[6]

This has led to the need for a tool to demonstrate waste management and zero waste efforts, and zero waste certification systems have been developed by different countries. Zero Waste Certification is composed of evaluation items based on the 5Rs and aims to ultimately achieve zero waste through waste management and treatment. The efforts of these companies are objectively evaluated through third-party verification called Zero Waste certification.

In South Korea, the Institute of Global Sustainability Certification (IGSC) developed and operates zero waste certification in 2021, and supports companies that are practicing zero waste efforts through their services and products to reduce the risk of greenwashing and continue to practice sustainability through certification. In addition, we are trying to improve the certification system by identifying domestic and international environmental trends and regulations.

Starting with a theoretical review of zero waste certification, this study first compares zero waste certification systems operated by certification bodies in four countries: Korea, Japan, the United States, and Europe.

Secondly, based on the comparison results, we identified the limitations and improvement measures of Korean zero waste certification, reflected the improvement measures to the existing certification system, improved the certification system, evaluated the existing certification cases, and identified the differences between the evaluation results of the revised certification system and the existing certification system.

1.2 Scope and Methods

The scope of this study is to compare and analyze the background of the introduction of the certification system, the certification evaluation system, the operating system, and the evaluation targets and items through a literature survey of the representative zero waste certification bodies in each country, namely IGSC in Korea, Zero waste Japan, TRUE in Japan, and Zero waste Europe in Europe.

Based on this, we analyzed the limitations of the Korean zero waste certification and ways to improve it, revised the certification, and considered the results of the re-evaluation of Company A, which had obtained the existing zero waste organization certification, to suggest the direction in which zero waste certification should go in the future.

However, the internal evaluation criteria used by each certification bodies could not be identified, so the research was conducted using publicly available certification criteria and data.

2. ANALYZE ZERO WASTE CERTIFICATION SCHEMES BY COUNTRY

2.1 South Korea

South Korea's zero waste certification was developed in 2021 by the Institute of Global Sustainability Certification (IGSC), a private certification body. IGSC's zero waste certification was developed based on the ISO 17065 standard and is accredited by the National Accreditation Center (NAC), a U.S. accreditation body, and is available in approximately 166 ISO member countries.

The certification process consists of consultation, request for application form and related documents, quotation and contract signing, document review, on-site audit, request for non-conformity and corrective action supplement, certification review committee meeting, and certificate issuance.

As shown in Table 1, the validity period is one year, and renewal is required before the expiration of the period. Certifications are divided into products and organizations and services. Product certification is for products made by organizations that are committed to reducing or minimizing waste, while organization and service certification applies to organizations, sites or stores, and event programs such as ceremonies, rituals, festivals, and business services.

Certification levels apply to the certification of organizations and are divided into four levels: Certified (100-130), Silver (131-160), Gold (161-190), and Platinum (191-230). The top two levels require a quantitative assessment to be performed and additional requirements to be met.

For Organization and Service Certification, it consists of a comprehensive set of items that can be applied to any organization and service. There are seven assessment categories: Policy, Refuse, Reduce, Reuse, Recycle, Rot, and Innovation.

The Policy section requires the organization to establish and document a zero waste policy, which must be signed by a representative of the organization. It also includes items related to waste management, which requires recording and monitoring of waste, and evaluates the zero waste practices of organizations and services through evaluation items for each of the 5R categories.

Specifically, in the Innovation category, a company can earn points if it encourages a wide range of environmental practices, including participation in environmentally-related programs (upcycling programs, flogging, environmentally-related markets/fairs, etc. In addition, a company's commitment to zero waste is evaluated through the process, design, and raw material improvement categories. There is an add-on point system for these items, indicating that practical efforts through improvement/change are highly valued.

Furthermore, Korean zero waste certification is most distinctive from other certification bodies in that it certifies products. The evaluation criteria for product certification varies depending on the material of the product, but in general, like the criteria for zero waste organization certification, it requires zero waste policies and waste management and focuses on packaging minimization. In addition, the criteria for product certification is relaxed for organization certification, reflecting the fact that the product is made by an organization that is committed to waste minimization, as evidenced by the definition of what is certified. [7]

Table 1. South Korea zero waste certification overview

Item	Contents
Operating Authority	Institute of Global Sustainability Certification (IGSC)
Year of implementation	2021
Related standards	ISO 17065
Scope	Products, organizations, and services
Certification level	Certified / Silver / Gold / Platinum
Validity period	1 year
Evaluation category	Policy + 5Rs + Innovation
Features	Product certifications, process/design/raw material improvements, and participation in environmental programs
Certification Marks	 

2.2 Japan

Japan's zero waste certification was developed by the non-profit organization Zero Waste Japan (NGO). Zero Waste Japan started with the Zero Waste Store Academy (ゼロ・ウェイストアカデミー , NPO), which led to the zero waste Declaration of Kamikatsu Town. It was determined that 20% of total waste could not be zero waste without changes in product design and materials, so the program was expanded to include business certification to work with companies.

Certification is a process of application submission, hearing, on-site inspection, review committee, and notification of results, with renewal required annually. Renewal follows the following sequence: annual report and plan submission, hearing, site inspection.

The certification targets are broadly divided into local governments and businesses, with business certifications consisting of restaurants, apparel stores, and coworking spaces. In particular, the fact that zero waste certification is applied at the village level is a major feature of Japan's zero waste certification.

For each certification level, there are separate certification marks, which can be obtained by fulfilling the requirements for each certification mark.

One of the most distinctive aspects of Japan's zero waste certification is the use of local food. The goal is to use locally produced food, and to minimize food waste within the local area. This seems to be related to the evolution from local government certification to business certification.

Another distinctive feature is that it encourages consumer (customer) participation in the zero waste movement. The presence of mechanisms that allow users to learn about Zero Waste and participate in initiatives is one of the evaluation criteria, indicating that Japanese zero Waste certification emphasizes user participation. This is also evidenced by the fact that the program focuses on raising awareness through a board game based on zero Waste. [8]

Table 2. Japan zero waste certification overview

Item	Contents
Operating Authority	ZeroWaste Japan
Year of implementation	2017
Related standards	-.
Scope	Municipalities, businesses (restaurants, clothing stores, coworking spaces)
Certification level	Different for different certification targets
Validity period	1 year
Evaluation category	5Rs, user participation in zero waste, employee training, etc.
Features	Education and awareness through customer engagement items, board games, and more + municipal certification
Certification Marks	

2.3 United States

Zero Waste certification in the United States was developed by the Green Business Certification Inc. (GBCI) in 2016 and has been administered by Total Resource Use and Efficiency (TRUE) since 2017. GBCI is the same organization that developed LEED, the green building certification, and this background is reflected in the zero waste certification, which is based on certifying buildings.[8]

TRUE's Zero waste certification states compliance with federal, state/provincial, and local solid waste and recycling laws and regulations, and in some areas considers compliance with the U.S. EPA's environmental policies.

The certification process is as follows: register the project, prepare supporting documents, submit the application and documents and pay the certification fee, conduct a preliminary review, submit the final review documents, accept the final review report, and obtain certification. The certification is valid for three years, and annual data (last 12 months) must be reported annually.

Certification scope is categorized into facilities/buildings, events, and construction. Once you achieve the minimum number of credits (31 points), you'll be awarded four tiers of certification based on the number of credits you earn: Certified (31-37), Silver (38-45), Gold (46-63), and Platinum (64-81).

There are 15 assessment categories, including the 5Rs, Zero Waste Reporting, Zero Waste Purchasing, Leadership, Training, Zero Waste Analysis, Upstream Management, and Hazardous Waste Prevention.

It's worth noting that the Zero Waste Reporting assessment category not only encourages data tracking, but also climate impact reporting and participation in the US EPA's Waste Wise program. This suggests that the TRUE certification is aligned with US legislation. Compared to other certifications, Leadership actively encourages senior management decision-making and assesses how the organization works to motivate employees to participate. There is also a section on recording and handling hazardous waste, and the percentage of recycled content in office and janitorial paper products.[9]

Table 3. US zero waste certification overview

Item	**Contents**
Operating Authority	TRUE
Year of implementation	2016
Related standards	Comply with U.S. federal law

Scope	Facilities/Buildings, Events, Construction
Certification level	Certified / Silver / Gold / Platinum
Validity period	3 years
Evaluation category	5R + Zero Waste Reporting, Zero Waste Purchasing, Leadership, Training, Zero Waste Analysis, Upstream Management, Hazardous Waste Prevention, Closed Loop, Innovation
Features	Building standards, Construction certification
Certification Marks	 

2.4 Europe

Zero Waste Europe is an NGO founded in 2014 as the European regional chapter of the Global Alliance for Incinerator Alternatives (GAIA).[9] The Mission Zero Academy (MiZA), which currently offers Zero Waste certification, is a spin-off of Zero Waste Europe (ZWE), a European non-governmental organization first conceived in 2018 but officially founded in March 2021. Zero waste certification in Europe is based on EU policy. [10]. The process is as follow, Initiate (assess recent situation), change (implement zero waste strategy, meet certification criteria), achieve goals (set new goals, report progress), audit (obtain certification, set new goals), further improve (maintain rating, reach new sustainability rating), and submit public reporting once a year. The plan is then updated to set the next set of goals to continue the zero waste effort.

The certification scope is divided into cities and businesses, and the business certification is subdivided into hotels, restaurants, offices, and events. The audit process is based on a general module that applies common criteria and then evaluates each business through specific criteria.

The general criteria refer to a zero waste hierarchy which is in Figure 2 and require goal setting accordingly. It is divided into infrastructure, secondary processes, waste management, communication, and innovative ideas. The most unusual part of the European standard is the communication part, which focuses on building relationships, including sharing best practices with other organizations. It can be seen that the European zero waste certification emphasizes internal and external communication of the organization.

In the hotel and office criteria, there is a section on the use of disposables related to consumer goods, as these industries tend to use a lot of consumer goods, and they are required to evaluate whether they use eco-marked products and are encouraged to inform customers about their zero waste policy.

For City certification, items are divided into three categories: preparation, implementation, and communication. Due to the large-scale nature of municipal certification, it's important to collect statistics and data to come up with a plan to minimize waste. There are also sections on appointing a manager and organizing a team for efficient management.

Europe particularly emphasizes networking with other municipalities and encourages awareness-raising activities to educate the next generation to sustain zero waste efforts. There is also an assessment of alignment with the United Nations' Sustainable Development Goals (SDGs), indicating that there is a recognition that the waste problem is not limited to a specific company or country, but rather a global cause and effect. [11]

Table 4. Europe zero waste certification overview

Item	Contents
Operating Authority	Zero Waste Europe
Year of implementation	2014
Related standards	EU Policy
Scope	Cities, businesses (hotels, restaurants, offices, events)
Certification level	Levels 1, 2, and 3
Validity period	1 year
Evaluation category	General module + Hotel/Office/Restaurant etc.
Features	Foundation, Core process and Material Flow, Infrastructure, Secondary

	Processes, Waste Management, Communication, Innovative Idea
Features	General module + specific module, City certification
Certification mark	

Figure 2. Zero waste Hierarchy

2.5 Comparison results

Table 5 compares the highlights of each certification authority's assessment categories. We've marked with an O if an evaluation item is included, an X if it's not, and a △ if the item is present but less clear than other certification bodies.

First, all four certification body have a common assessment for a zero waste policy, which requires that the policy be adopted by top management/leadership and applied throughout the organization. They also require that the organization have goals and plans for waste reduction, and that the organization have ongoing monitoring of plan implementation and waste disposal.

Also common were working with suppliers to prevent waste from entering the organization, reducing the use of single-use products, ensuring the disposal of non-recyclable waste, and educating and engaging employees.

In terms of certification scope, Korean certification covers comprehensive organizations and services, while other certification bodies are more specific by industries. In Japan and Europe, zero waste certification is also applied from a macro perspective at the town and city level, while in the United States, buildings, facilities, and construction projects are also covered.

In addition, the main differences shown in Table 5 are as follows Setting targets and plans for each tier of zero waste in zero waste policy formulation, conducting screening and analysis of waste targets and taking action on them, and managing waste upstream and downstream.

In the 5Rs, the differences are in the review of and actions taken against suppliers, consideration of preferential purchasing of environmentally friendly products (policy), no-packaging and metered sales to reduce waste, goals related to reuse, recycling screening and analysis, and communication. In addition, overseas certification bodies have a zero waste assessment component for infrastructure, which covers the structure of the office, interior furnishings and materials.

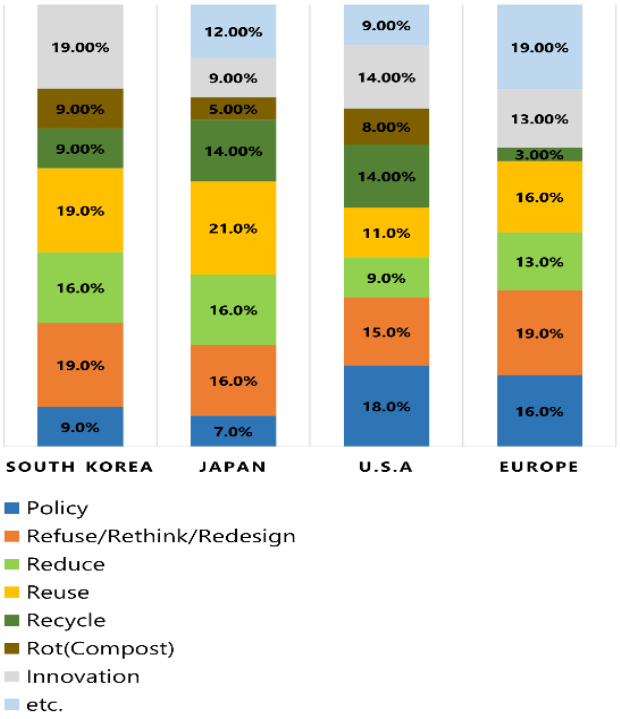

Figure1. Comparison of the certification principles by certification bodies

Figure 1 is a graph that quantifies the weight of each of the 5Rs within the evaluation items for each certification bodies.

In the case of Korean certification the categories of Refuse, Reuse, and Innovation each accounted for a significant proportion of 19%. In Japan, the Reuse category made up 21%, while in the United States, the Policy category accounted for 18%. In Europe, the categories of Refuse/Rethink/Redesign and Innovation each held a significant proportion of 19%.

3. REVISION AND EVALUATION OF THE CERTIFICATION

Through the comparison of the certification systems in each country, we were able to highlight the current status and limitations of the Korean zero waste certification system.

And through the comparison of certification systems across countries, the limitations and areas for improvement in Korea's zero waste certification were identified. However, not all of these limitations have been addressed in this study; the limitations from a macro perspective were excluded.

3.1 Limitations and Improvements of the certification

First, it is the only zero waste product certification system among the countries compared, and although it is a private certification scheme, it is operated by a certification body that has undergone the accreditation process according to the ISO 17065. However, it has the following limitations, and we have taken measures to improve it accordingly.

First of all, it does not include a macro-level certification scope. Korea's zero waste organization and service certification focuses on small and medium-sized enterprises and does not include municipalities such as towns or cities. While individual and corporate actions are important, systemic and structural actions are essential for zero waste in practical, so it is necessary for the certification system to lay the foundation for realizing zero waste from a macro perspective through certification that can be applied to regions and cities.

Second, the evaluation system is comprehensive. Korea's zero waste certification evaluates all organizations under one certification assessment system for "Organization and Service". Because it applies common and generic evaluation items, there is a limit to being evaluated according to industry-specific characteristics. For example, when applying the certification criteria to a coworking space, it is necessary to evaluate items related to itself rather than product manufacturing and sales, packaging materials, and other aspects that do not align with the characteristics of the industry. If such items are not applicable, it becomes impossible to earn points. Therefore, it is necessary to develop an evaluation system that reflects the characteristics of each

industry to obtain more accurate and reliable evaluation results.

Table 5. Key Results of the Comparison of Evaluation Criteria by Country

Item		South Korea	Japan	USA	Europe
Scope	Business	O	O	O	O
		· Organization/Service · Event	· Restaurant · Apparel store · Office	· Building/facility · Construction project · Event	· Hotel · Restaurant · Office · Event
	Product	O	x	x	x
	Municipalities	x	O	x	O
Policy	Adoption by top management	O	O	O	O
	Overall goal/plan based on 'Zero waste hierarchy'	x	x	x	O
Waste management	Waste reduction goal	O	O	O	O
	Recording and monitoring	O	O	O	O
	Waste audit/analysis and implement the result	x	x	O	O
	Upstream management	△	△	O	O
	Downstream management	x	x	O	O
Refuse/ Rethink/ Redesign	Prevention of waste from suppliers	O	O	O	O
	Supplier review	x	O	O	x
	Take action after supplier review	x	O	O	x
	Green purchasing priority (policy/certified product)	x	x	O	x
Reduce	Offer unpackaged, metered sales	x	O	x	O
	Reduce disposables goods	O	O	O	O
Reuse	Reuse goal/system/plan	x	x	O	O
Recycle	Recycling audit/analysis	x	O	O	O
	Check handling of non-recyclable waste	O	O	O	O
	Upcycling	O	O	O	x
Rot(Compost/Biodegradable)		O	O	O	x
Innovation		O	x	O	△
Communication(Reporting/Annual review/Best practice)		x	O	O	O
Training		O	O	O	O
Infrastructure		x	O	O	O

Third, there is a lack of assessment of waste management. While the assessment requires companies to set waste targets, record and monitor volumes/weights and costs, there is no requirement to annually review or assess the organization's waste reduction goals and metrics to see how they are progressing toward achieving them.

In addition, the existing evaluation system includes waste management items within the zero waste policy category, so it is necessary to separate the category to give weight to waste management, and it is necessary to set goals and plan according to the Zero waste hierarchy to materialize the goals of zero waste practices in the policy.

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Finally, there is a lack of sharing and communication of zero waste practices. While there is an assessment of zero waste training for employees within the organization, there is a lack of assessment of communication with the supply chain, market, service users, and other stakeholders of the organization before and after certification. There is a need for a section to assess the sustainability and scalability of zero waste practices by proactively communicating with suppliers about the zero waste policy and targets set, collaborating to eliminate waste, and sharing zero waste best practices with relevant stakeholders.

3.2 Revision of the certification

Initially, in order to improve the evaluation system to better suit the characteristics of each industry, we selected offices (including coworking space) from various organizations and revised the certification system with evaluation criteria appropriate for this industry. An office is defined as a space where office work is typically carried out, rather than a facility for product manufacturing, and this definition also includes shared office spaces.

The revisions were made based on the improvement measures derived from the comparison of countries, and the results are shown in Table 6. Overall, there have been changes in the total number of assessment items and the total score, which is partly due to the addition of new items, but also influenced by the consolidation or deletion of existing assessment items.

3.2.1 Separation of the Evaluation category

As shown in Table 6, the existing integrated assessment criteria were organized based on seven large categories consisting of zero waste policy (including waste management), 5Rs, and innovation assessment items, without dividing them by industry, but the communication category was added to the zero waste policy, waste management, and innovation items to form a common assessment system.

We also organized a separate 5R evaluation item for the office (coworking) industry. First, we expanded Refuse to Refuse/Rethink/Redesign. We removed the evaluation items related to product sales and packaging materials, which were applied regardless of the industry, and from the perspective of the office industry, we prioritized the purchase of environmentally certified products, organization

We've added new sections on how to prevent waste in your personal belongings, reducing waste associated with disposables and tributary items, and more.

Table 6. Comparison of the old and revised certification

Item		**Original**	**Revision**
Scope		Integrated criteria for all organization	Separate criteria by organization
Criteria category		Policy + 5Rs + Innovation	**General** (Policy + Waste management +Communication+ Innovation) + **5Rs(By business sector)**
Total number of criteria		32	35
Sub point	**Policy**	20	20 (Max: 25)
	Waste management	15	30
	Refuse (Rethink/ Redesign)	60	45 (Max: 55)
	Reduce:	40	35
	Reuse	35	40
	Recycle	20	20 (Max: 30)
	Rot	25	15
	Innovation	30 (Max:60)	30
	Communication	-	20

Total point		235 (Max : 265)	250 (Max: 280)
Level	**Certified**	100 to 130	130 to 160
	Silver	131 to 160	161 to 190
	Gold (+ waste measurement)	161 to 190	191-230
	Platinum (+ waste measurement + waste reduction)	191-230	231

3.2.2 Separation of policy and waste management and add extra assessment items

The most significant change in point weighting is for the zero waste policy and waste management components. Previously, policy included waste management and was worth 25 points, but now policy and waste management are separated, with policy worth up to 25 points and waste management worth up to 30 points. The total number of points for the zero waste policy evaluation is 55, an increase of 30 points from the previous evaluation.

In particular, the zero waste policy adds the requirement for organizations to set tiered zero waste targets and plans for Zero Waste implementation, while traditional waste management requires the specification of waste reduction targets and the recording and monitoring of waste volume/weight.

3.2.3 Add a communication category

In addition to the existing internal employee zero waste training, we added a new category within the Common Scorecard, Communication, to include an assessment of an internal review of progress against zero waste goals and key metrics at least once a year to review the waste reduction targets the organization has set for zero waste practices, the zero waste Tier Action Plan, and any waste reduction status or recommendations. We also added an assessment component on sharing the organization's zero waste practices best practices internally and externally.

3.2.4 Expansion of the reuse and recycling item

In addition, the reuse and recycling score has been increased by 15 points compared to the previous score, and items related to goal-setting and planning for reuse and recycling have been added to encourage organizations to review their resources and recommend actions to reuse, recycle, and reuse them. In the Reduce category, scores were lowered by removing the items "Reducing product packaging" and "Reducing product descriptions/advertising documents" and adding new items tailored to the office industry, such as "Reducing packaging use by purchasing products in bulk" and "Implementing unpackaged or weighed sales when providing food or office supplies". The scoring has been adjusted with the addition of an item related to "Efforts to reduce disposables and supplies provided by the organization".

3.3 Evaluation of the certification

To compare the revised certification system with the existing certification system, the same auditor who conducted the existing certification audit for Company A, which is certified zero waste organization and service certification by IGSC, re-evaluated with the revised evaluation system.

Company A's business type is service industry and it is engaged in branding, design and exhibition agency business. Since an on-site audit was conducted during the certification process, this evaluation omits the on-site audit and is based on document review only.

4. RESULT

As a result of the re-evaluation of Company A, existing certified organizations under the revised certification scheme, there was a difference in the resulting certification level. Due to the increase in the number of assessment items and the change in the weighting of the points, the total score of the entire assessment system and the threshold score for determining the certification level increased, resulting in a Certified level, which is one level lower than the previous Silver level. The following factors contributed to the difference in outcomes

First, setting goals for each level of Zero waste hierarchy, as well as evaluating and analyzing waste management criteria and items. The previous certification standard did not require organizations to set targets and create action plans for each level of Zero waste hierarchy, and while waste management monitoring was optional, there was no evaluation of the actual implementation process. With the improvement of these items,

organizations are expected to set various goals for each zero waste tier and implement zero waste practices in addition to simply reducing waste generation.

Next, the applicable evaluation items have been changed due to the segmentation of the evaluation checklist by industry. As we refined the evaluation items for the office industry, Company A could not meet some of the newly added evaluation items. In particular, the items added when the 5R Refuse category was expanded to Refuse/Rethink/Redesign, which is whether the organization prioritizes purchasing environmentally friendly products at the purchasing stage to prevent waste from entering the organization, and the items related to reviewing, setting goals, and implementing reusable and recyclable items in the organization added to the Reuse, Recycle category, were affected. In addition, the items related to efforts to reduce disposable items and equipment provided by the organization in the Reduce category were affected.

In summary, in order to improve Korea's certification system through the comparison of national certification systems, there was a need to include a macro perspective in the scope of certification, subdivide the certification criteria by industry, add an assessment item on whether the organization evaluates and inspects waste management within the organization, and add an assessment item on communication to share best practices and efforts on zero waste practices. As a result of the revised certification system, the certification level was lowered, but the detailed assessment items allowed us to evaluate the organization's actual zero waste practices from a more diverse perspective.

5. CONCLUSION

This study first analyzed and compared the zero waste certification systems in Korea, Japan, the United States, and Europe through a literature review. Through the comparison by country, the limitations and improvement measures of Korea's zero waste certification were examined, and finally, the certification system was revised, and the evaluation results were compared by applying it to Company A, which was already certified, and the conclusions were as follows.

First, the principles and concepts of Zero Waste are expanding and refining, requiring more than just reducing waste, but also reducing, reusing, and recycling resources in the process. The certification system, which is being utilized as a tool to showcase zero waste practices and efforts through third-party verification, should also be expanded and refined to evaluate various zero waste practices to reflect the characteristics of each industry.

In this study, we developed and piloted evaluation criteria for offices, but we plan to develop a detailed certification evaluation system that can be applied to various business areas such as hotels, restaurants, and product manufacturing and sales.

Second, although not covered in this study, zero waste must be accompanied by systematic and structural practices in addition to individual and corporate practices. While overseas certification systems include village-level and city-level certification scopes, South Korea's zero waste certification system lacks a macro-level certification scope, and it is considered necessary to revise it.

In addition, it is recommended that product certifications that are subject to Korean zero waste certification be revised to reflect these trends in line with overseas packaging and waste-related regulations and trends that are being revised and enacted to reduce waste.

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