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Taiwan Green Building Material Labeling System and Its Application to Green Building Design

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ABSTRACT

In line with low-carbon policies around the world, the government has promoted the Green Building (GB) and Green Building Material (GBM) labeling policy in Taiwan. First implemented in 2004, 1,888 labels had been certified for 13,595 products as of the end of 2017. Since 2006, the building code has required usage of 5% GBM products for the interior surface of public use buildings. The requirement was raised to 30% in 2009 and then to 45% of interiors and 10% of exteriors in 2012. Recently, the quality and reputation of GBM products have improved, and many consumers are requesting that GBM products be used in their private buildings as well.

In this paper, we collected and analyzed statistical data of GBM labels to evaluate the GBM policy's effectiveness. Furthermore, we summarized the connection between GBM and the GB labeling system set forth in the 2015 version of the manual to discuss the motivation for the building material industry. The number of effective products in the official database continue to increase, exceeding 2000 products in 2009, 3000 products in 2013, and 4000 products in 2015. At the end of 2017, these effective products consisted of 87.2% healthy GBM, 10.4% recycled materials, 6.7% high-performance, and 0.2% ecological products. This percentage distribution clearly indicates that the health issue has been highly emphasized and represents the development trends of the building material market in Taiwan. Within the health category, wall panels and paint occupy 40.4% and 40.2%, respectively, followed by flooring with 14.1%, and 5.3% cumulatively for ceilings, sealing, and adhesives.

The GBM Labeling System is properly coordinated with the GB evaluation system in all indicators, thus providing a strong driving force for the green built-environment market. Nevertheless, the policies can be further integrated and applied to the development of smart eco-cities in subtropical zones.

***KEYWORDS*:** Health, Recycling, High-performance, Ecology

1 Introduction

In line with low-carbon policy trends around the world, the government has promoted the Green Building (GB) and Green Building Material (GBM) labelling policy in Taiwan. First implemented in 2004 (Chiang, et al., 2004),and the GBM labelling policy was developed based on the ISO15686 series, ISO21930 series, and ISO14040 series, as well as the Integrated Building Performance (IBP) system proposed by the EU, to ensure the evaluation criteria and standards meet the current development trends of the rest of the world (Ho, et al., 2008; Chiang, et al., 2009).

With “Humanistic Health; Sustainable Earth” as the main concept of the GBM Label and considering the methodology of the life cycle assessment (LCA), the GBM framework was developed as shown in Figure 1. Four categories, including ecological GBM, healthy GBM, high-performance GBM, and recycling GBM, were then defined based on those concepts (Ho, et al., 2006; Hsieh, et al., 2009).

When applying the GBM labelling system, a comprehensive evaluation indicator based on the concept of eco-efficiency was proposed (Hsieh, et al., 2012) for comparing the four categories of GBM. To evaluate the influence of GBM on the building material market, a study on the willingness to pay (WTP) and willingness to accept (WTA) GBM was carried out to determine the cognitive level of consumers in Taiwan (Tsay & Chang, 2017). The results showed that the WTP of GBM is 13.6% (extra pay), which is superior to famous brand products. Therefore, the quality and reputation of GBM products have improved, and many consumers are now requesting GBM products more than ten years after the policy was first promoted.

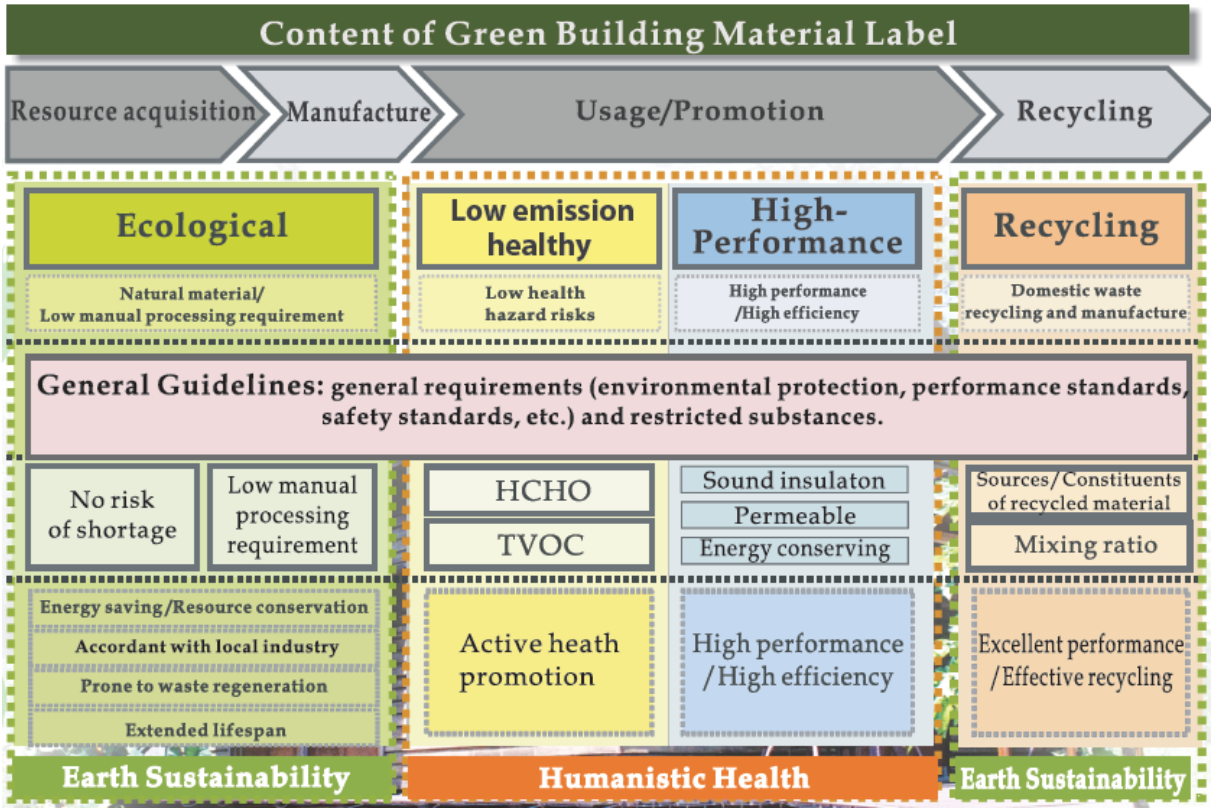

Figure 1 The framework of life cycle assessment in the GBM label system

According to official data of the Architecture and Building Research Institute (ABRI), as of December 2017, 1,888 labels had been certified for 13,595 products. Since 2006, the building code has required usage of 5% GBM products for the interior surface of public use buildings. The requirement was raised to 30% in 2009 and then to 45% of interiors and 10% of exteriors in 2012.

2 Achievements of the GBM policy

In this paper, we collected and analyzed statistical data of GBM labels from the ABRI (Architecture and Building Research Institute, Ministry of the Interior, Taiwan), an official government department, to evaluate the effectiveness of the GBM policy. The number of labels certified each year from 2005 to 2017 is shown in Figure 2.A growing trend of labels certified is shown, and the amounts exceeded 200 labels starting in 2013, thus demonstrating the stability of the GBM market.

An official database on the website was established for announcing GBM products for users (ex: architects or consumers). The total effective labels in the official database have also shown the growing trend in recent years, and the number of labels has exceeded 500 since 2013, as shown in Figure 3. The total effective products in the official database continue to increase, exceeding 2000 products in 2009, 3000 products in 2013, and 4000 products in 2015, as shown in Figure 4. The number of effective products means that architects/interior designers can choose from a greater quality of products during the design process.

Note that the certification period of each product is 3 years and can be renewed once (for a total of 6 years). This means that the GBM product should be profitable on the market so that the company can renew the certification and maintain the same number of effective labels/products.

As of the end of 2017, these effective products consisted of 87.2% healthy GBM, 10.4% recycled, 6.7% high-performance, and 0.2% ecological products. The percentage distribution clearly indicates that the health issue has been prioritized and represents the development trends of the building material market in Taiwan. Furthermore, within the health category, wall panels and paint occupy 40.4% and 40.2%, respectively, followed by flooring with 14.1%, and 5.3% cumulatively for ceilings, sealing, and adhesives.

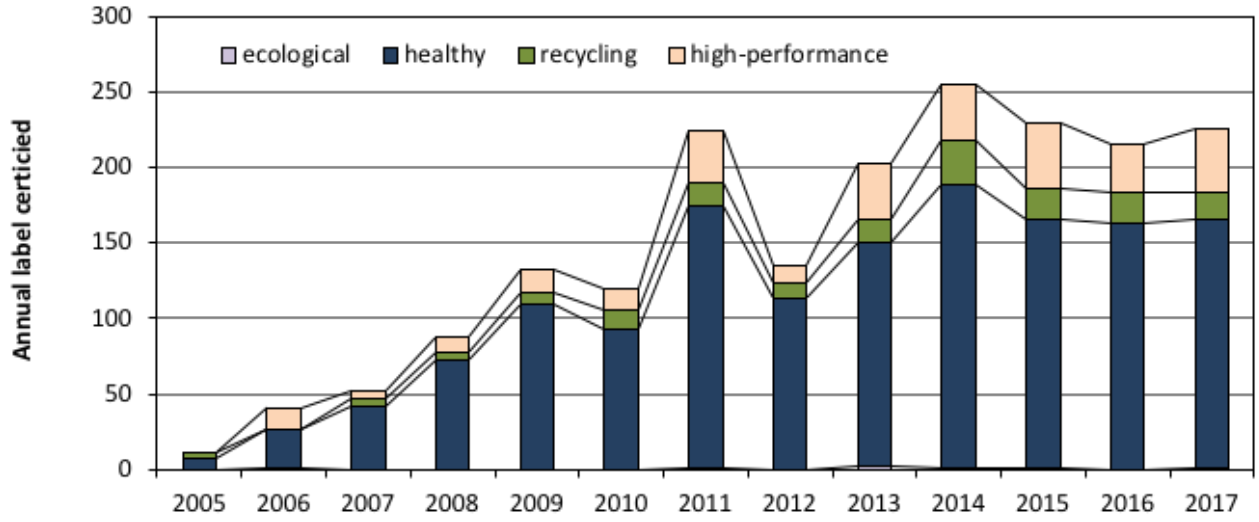

Figure 2 The number of labels certified annually from 2005 to 2017

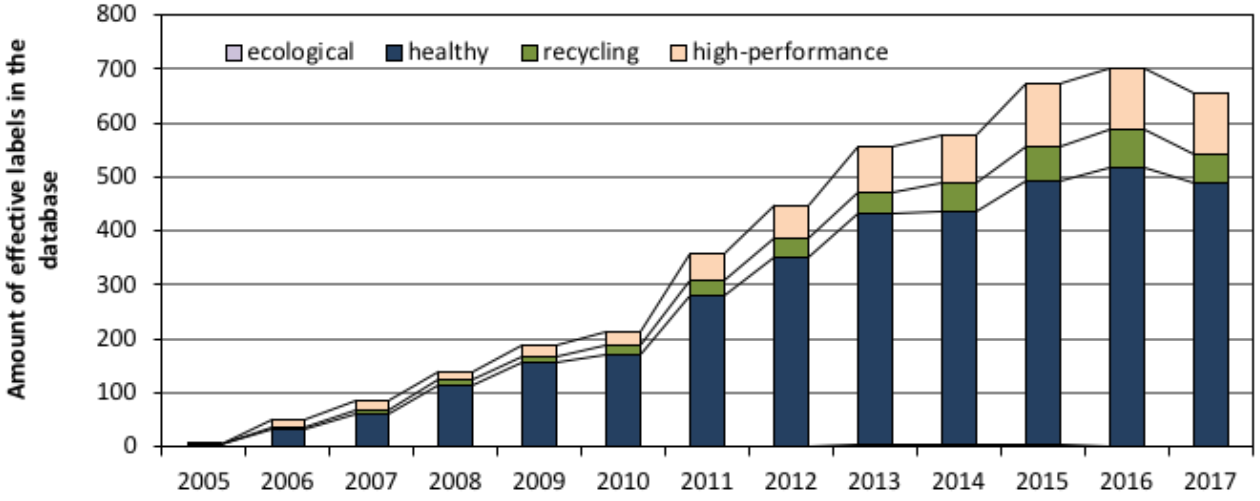

Figure 3 The amounts of effective labels in the official database from 2005 to 2017

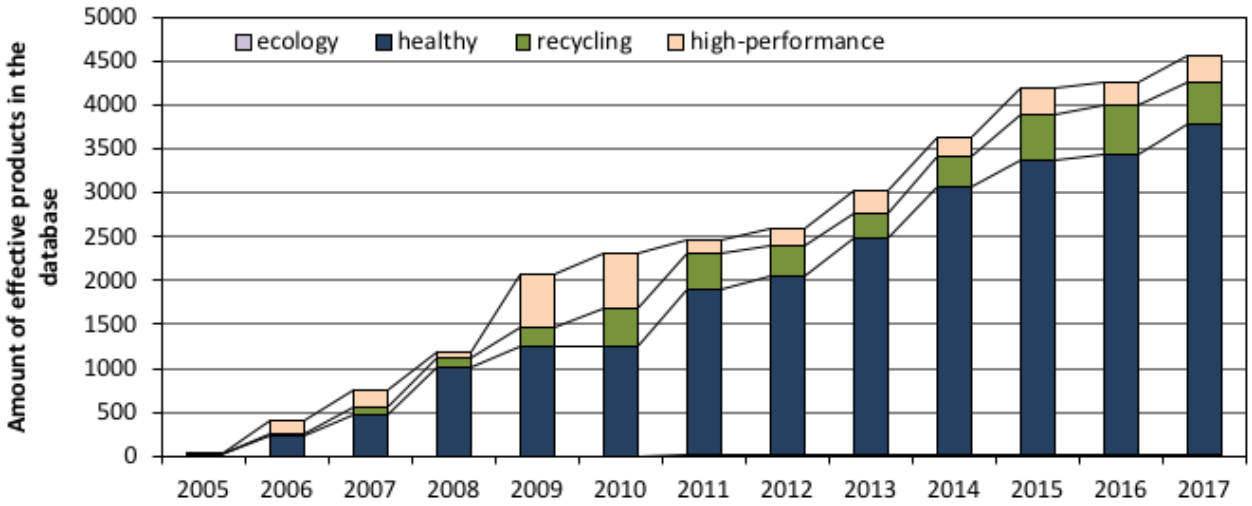

Figure 4 The amounts of effective products in the official database from 2005 to 2017

3 Connection from GBM to GB

In Taiwan, the GB rating system, also called the EEWH rating system, has the following four categories: ecology, energy saving, waste reduction, and health (Table 1). In this study, we summarized the connection between GBM and the GB labeling system set forth in the 2015 version of the manual (Tsay, et al., 2015; Lin, et al., 2015) to discuss the motivation for the building material industry, as shown in Table 2.

The GBM Labeling System is properly coordinated with the GB evaluation system in all indicators, thus providing a strong driving force for the green built-environment market. Nevertheless, the connection of policies can be further improved and applied to the development of smart eco-cities in subtropical zones.

Table 1 The rating system (EEWH) of green building labels in Taiwan

Category	Contents	
	Indicator	Evaluation Items
Ecology	1.Bio-diversity	Ecological network, biological habitat, plant diversity, soil ecosystem
	2.Greenery	CO_2 absorption (kg-CO_2/(m^2.40yr))
	3.Water content of the site	Water infiltration and retention, storm water runoff management
Energy Saving	4.Daily Energy Conservation	Building envelope design ENVLOAD (20% higher than building regulation) and other techniques (including HVAC system, lighting, management system)
Waste Reduction	5.CO_2 Emission Reduction	CO_2 emission of building materials (kg-CO_2/m^2)
	6.Construction Waste Reduction	Waste of soil, construction, demolition, utilization of recycled materials
Health	7.Indoor Environment	Acoustics, illumination, ventilation, and interior finishing building materials
	8.Water Conservation	Water usage (L/person), hygienic instrument with water saving, grey water reuse
	9.Sewage and waste disposal facility improvement	Sewer plumbing, sanitary conditions for garbage gathering, compost

Table 2 The connection of GBM and GB rating system

Category of GBM	Indicator of GB(EEWH)	Scoring in GB rating system
Ecological GBM (Wooden Material)	Indoor Environment	■ Natural material
	Construction Waste Reduction	■ Wooden structure
	CO_2 Reduction	■ Wooden structure
High Performance GBM (Permeable Pavement)	On-site Water Retention	■ Permeable paving ■ Permeable drainpipes ■ Permeable drain wells ■ Permeable trench drains
Recycling GBM	Construction Waste Reduction	■ Usage rate of recycled and recyclable materials
	CO_2 Reduction	■ Usage rate of recycled and recyclable materials
Healthy GBM (Low-Emission Material)	Indoor Environment	■ Interior finishing material ■ Natural Material
High Performance GBM (Acoustic Insulation)	Indoor Environment	■ Acoustic Environment
High Performance GBM (Glazing Glass)	Daily Energy Conservation	■ Energy consumption of building envelope

4 Conclusion

In this study, we introduced the GB and GBM policies in Taiwan and analyzed the statistical data of GBM labels to evaluate the achievements of the policy and its effect on the building material industry. Our results indicated that the effective labels/products showed a stable and sufficient amount for the market, thus representing the business model established in the building material market via GBM and GB rating systems.

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臺灣綠建材標章制度與綠建築設計之應用

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摘 要

在因應氣候變遷、地球暖化的議題之下，十多年來我國已因應全球規模的低碳政策發展趨勢，積極推行綠建築與綠建材政策。綠建材標章從2004年開始推行，至2017年底已發出1,888個標章認證，涵蓋13,595種產品。內政部自2006年起於建築技術規則中明訂綠建材使用率為5%，並於2009年調高至30%，於2012年調高至室內45%、戶外10%，可說是綠建材產業最重要的推手之一。近年來，因綠建材認證制度而建立的品質與品牌效益，已驅使更多消費者於私人建築工程中要求使用綠建材產品。

本研究針對過去取得綠建材之產品進行資料收集與分析，以探討綠建材標章認證政策之效益。另外，也分析同為2015年版之綠建築標章與綠建材標章手冊，探討兩評分系統架構與系統之對應關係。分析結果發現官方網站所公告之有效標章中，產品數量呈現持續成長，於2009年超過2,000種產品、2013年超過3,000種產品，更於2015年起持續超過4,000種產品，這個趨勢與建築市場景氣變動較不相關，顯示綠建材產品於市場上具有確保基本市場、穩定獲利之特質。截至2017年底的統計顯示，有效產品數量中健康綠建材佔87.2%、再生綠建材佔10.4%、高性能綠建材佔6.7%，而生態綠建材佔0.2%，顯示健康綠建材於近十年臺灣建材市場發展中的接受度最高。在健康綠建材中壁板材與塗料佔比最多，分別佔了40.4%與40.2%，接著是地板材佔14.1%，而天花板、填縫劑、黏著劑等共佔5.3%。

綠建材標章之產品與綠建築評估系統之項目大致上是相對應的，也提供了綠建築產業帶動綠建材產品的驅動力，上下游市場的鏈結有助於綠色建築經濟環境的建構。未來期盼綠建築與綠建材的連結成為產業的核心，再擴充至智慧與綠色城市的評估體系。

關鍵字：健康，再生，高性能，生態