

Comparative Study on Environmental Performance Certification Programs of Building Materials. -Focused on Certification Methods using LCI DB-

Park Eun-Mi¹, Chae Chang-U², Lee Kang-Hee³

¹Korea Institute Of Construction Technology, Go-yang, Korea,
em0406@kict.re.kr

²Korea Institute Of Construction Technology, Go-yang, Korea,
cuchae@kict.re.kr

³Univ. of An-Dong, An-Dong, Korea,
leekh@andong.ac.kr

ABSTRACT: This study performed comparative analysis on environmental performance evaluation methods through analyzing contents of certification programs for building materials which are being performed in Korea and other countries. At present, about 5 certification systems are performed for building materials in Korea, but just Type1 Environmental Labelling and Type3 Environmental Declaration of Products are assessment methods for environmental performance which is dealt with whole life cycle of building materials. In other countries' systems, Environmental declaration programs are targeted by ISO 14000s. While other countries' environmental assessment of building materials is progressing as Environmental Declaration of Products(TYPE 3), but there is no product acquired Type3 in Korean building material industry. An assessment program of green building material is needed which is possible to provide confidence to manufacturer, customer, and end user backgrounded from National LCI DB establishment of building materials.

Keywords: Building materials, type 1.2.3. LCI DB

1. INTRODUCTION

1.1 Background and objectives

Numerous volume of resources is being used for building materials while huge residential facilities have been developed on growth of economy. Also, environmental impacts like New Building Syndrome are

increasing affected by indoor air pollution due to using more chemical interior materials and having building envelop tighter than before. Therefore, concerns for the environmental building materials are increasing while consumers prefer to use green building materials. As a result of survey for indoor air quality against big 12 construction companies in December, 2007,

a major response was positive preparation to use green building materials for 'improving indoor air quality', and 43% of the responses intended to invest cost for improving indoor air quality.

As customer's vision, the environmental building materials will be zero-emission materials, but a range will be extended when it's considered to global environment.

This study analyzed various certification systems which is being operated in the world, to establish outstanding direction for assessment of environmental performance of building materials.

1.2 Method of study

Firstly, it's analyzed by systems for environmental performance certification and the contents of environmental declaration by ISO. Then, it is suggested with the flow of the systems and verification method for environmental performance of building materials by domestic system analysis.

Secondly, it is reviewed to search Type3 assessing method and further direction of building material which is using LCA methodology. This is considering needs for introducing environmental declaration in the building industry while environmental declaration(Type3) of products based on LCA is extending in the world, and needs to grow confidence for environmental performance information of building materials through quantitative and transparent information to manufacturers, end-users, and customers

2. VERIFYING METHOD FOR THE ENVIRONMENTAL PERFORMANCE OF BUILDING MATERIALS

The environmental performance of products by ISO standard are provided three types of information as Type I , II and III.

Table I: ISO standards on Environmental Labelling and directives in Korea

classification	standard	legal basis and system
ISO 14020	Environmental labels and declarations General principles	
ISO 14021	Environmental labels and declarations ; Self declared environmental claims (Type 2 environmental labeling)	Act for fair indication and advertisement (Guide for environmental indication and advertisement)
ISO 14024	Environmental labels and declarations (Type 1 environmental labeling)	Act for environmental technology development and support(Environmental Mark System)
ISO 14025	Environmental labels and declarations (Type 3 environmental declarations)	Act for environmental technology development and support (Environmental record labeling system)

2.1 Environmental Labels (Type I)

As ISO 14024 Environmental Labels and Declarations, Type I was published to international standard in April, 1999. The purpose of I type is decreasing environmental impact related with products by examining the environmental of all products. An stakeholder gives Environmental Label to products which causes low environmental load. The Label system should consider environmental products from each product group with

whole life cycle, calculate environmental loads during whole life cycle of product like manufacturing, extraction of resource, transportation, use, and disposal, and consider environmental impact from environmental loads.

The Environmental Label system is very usual in the world, but all kinds of products which meet PASS-FAIL system are possible to acquire Label.

The critical problems are that it is possible to be used as trade barrier and influenced by political decision.

2.2 Self-Declared environmental claims (Type II)

Self-Declared Environmental Claim which tells the positions of companies is tend to be treated as a marketing strategy because it focused on environmental aspects from the viewpoints of companies themselves. As an advertising method, companies emphasize that their products are environmental one and it is expressed as one of their marketing methods as packaging label, advertisement and other communication tools. ISO 14021 presents that anyone like manufacturer, exporter, wholesaler and retailer is possible to declare environmental claims for profits with Self-Declared Environmental Claims.

In Korea, the Self-Declared Environmental Claims like 'Green product', 'No-polluted product', 'Easy dissolved', 'Organic product' are being used, but making decision for confidence of the product seems to be very difficult.

2.3 Environmental Declarations (Type III)

Environmental Declaration program is introduced for claim of more detailed information than Environmental Labelling from Europe, because their consumers are positive in using environmental products. Environmental Declaration provides overall data of products to the customers and it was standardized by ISO TC 207.

European nations like Sweden insist universalized Type III system, and it is very useful for international trade in Europe.

2.4 Further direction of Environmental Declarations

In Korea, all kinds of labelling as Type 1, 2 and 3 are used for the promotion of environmental products. Type 1 is called as Environmental Labelling, Type 2 is called as Environmental Declaration of Companies and Type 3 is called as Environmental Performance Declaration Program.

Type 2 which is declared by companies themselves is very popular in Korea and the next preferred one is Type 1 which is certificated by KOECO(Korean Eco-products Institute). Although Type 1,2 has been succeeded in popularization, they are criticized in confidence. Although Type 3 is failed to obtain interests from people because of complexity of methodology, expense charge and public relations, it's a quantitative assessment methodology and is possible to be obtained in confidence. At present, developed countries establish LCI DB for their own to make clear certification system for environmental labelling, in the field of building industry. For example, UK-Sustainable Homes, Germany-AUB and ECI, France-HQ and Canada-SB Tool, and Australia-GS Residential pilot are introduced.

3. CERTIFICATION METHODS FOR ENVIRONMENTAL BUILDING MATERIALS

3.1 Environmental Labelling (Type I)

3.1.1 Domestic Environmental Mark

Environmental Labelling (Type I) is being operated and 120 products has got certification based on Article 24 of Act for Developing and Supporting Environmental Technology from Ministry of Environment and KOECO. Environmental Labelling is operated by several groups (Ex. Government-EU and Czech, Private organization-US and Sweden, Cooperating Government and Private organization-

Germany and Japan), in other countries and Ministry of Environment and KOECO charge for it in Korea.

Table II: Number of Domestic Environmental Mark acquired companies and products

Product type	companies	products
EL241. paint	71	482
EL242. wallpaper	6	20
EL243. heat insulator	17	53
EL244. waterproof material	9	15
EL245. water permeable concrete product	2	4
EL246. indoor floor material	27	99
EL248. finishing material for wall and ceiling	9	28
EL249. floor noise insulator	2	2
EL250. window	8	37
EL251. adhesive	14	36
EL252. PVC sheet for decoration	15	32
EL253. double layer floor material	7	14
EL743. inorganic building material	109	312
EL744. slag finished product	20	46

3.1.2 Overseas Type 1 present state of building materials

Environmental Labelling (Type1) is shown with different aspects in each 25 operating country. Acquiring labelling is not easy in Germany and Northern European countries because their system is very strict, but it is very confident to their customers. Global operating Environmental Labels are Blue Angel(Germany), Nordic White Swan(northern European countries), Eco Mark(Japan), and Environmental Choice Mark(Korea).



Figure1: Operating TYPE1 country

TableIII: Overseas present state for Environmental Mark

Country	System	enforcement
Germany	Blue Angel	1979
Canada	Environmental Choice Program	1989
Northern Europe	Nordic Swan Label	1989
Japan	Eco Mark Program	1989
New Zealand	Environmental Choice New Zealand	1990
Sweden	Green consumerism and Ecolabelling	1990
U.S.	Green Seal	1991
EU	European Union Eco-label	1992
Taiwan	Green Mark Program	1992
China(HongKong)	Green Label	1995

3.2 Environmental Declarations (TypeIII)

3.2.1 Domestic Environmental record labelling system

Domestic Environmental Performance Declaration Program is being operated by KOECO from March, 2004 which is based on Act for Developing and Supporting Environmental Technology. At present, 27 products are certified by the Program. Acquiring cases for Environmental Mark of building materials are shown as Table 1, but there is no case for Environmental Performance Declaration certification. Until present, Domestic Environmental Performance Declaration Program is mainly

operated on electronics and electric fields, because that industry needs the certification for export their products to European Countries.

3.2.2 Present states for TypeII of overseas building materials

TypeIII on building materials is not operated in Korea, but it is being expanded in Europe. Especially, TypeIII certification has been using as critical information which is certified as environmental building materials in Sweden, Germany and UK, etc. LCA on building materials and LCI DB of building materials for environmental building certification system should be attached. Table 3 is shown countries and organization operating LCA program and TypeIII of building materials in developed countries.

TableIV: Domestic and Overseas present state for TYPE III

Country	Organization	LCA model	Type	Year
U.K.	BRE	Envest	III	1999
Holland	NVTB	Eco-Quantum	III	1999
	NL NEN		Method	2002
France	F AFNOR		III	2001
	CSTB	Escale		
Denmark	SBI	BEAT2000	III	2002
Finland	VTT / RTS.	LCA House	III	2001
	Environmental Organization Association		III	1997
Sweden	KTH	Eco-effect		
	Ecocycle		III	1997
	IKP	Build-It	Project	2000
Germany	AUB		III	2002
	Byggforsk		III	2000
Norway	NBI	Eco profile		1999
EU LEVEL	CEPMC		II	2000
Switzerla	SIA			1994

nd			
U.S.	NIST	BEES	
Canada	Athenasmi	Athena	
Korea	KOECO		I ,III
	KICT	APESS	2008

3.3 Group Quality Certification System for environmental building materials

An objective of Group Quality Certification System for environmental building materials is to provide fresh and healthy indoor environment. It assesses density of polluting materials to domestic building material or imported ones. Also, it makes sure low emitting technique of building material, and efficient control method and performance assessment method for pollutions, and assesses emitting characters by pollutions. The target products are not all building materials, but general materials like ply-wood board, floor material, timber, wallpaper and panel which are used for interior materials in the building. Also, assessment method is limited on emitting degrees of organic compounds(TVOC,. HCHO) from building materials. Group Quality Certification System for environmental building materials has systemic limitation because it is not for overall building products and overall lifecycle stages of the materials.

Table V: Building material certification of HB system

field	certificated companies	certificated products
waste plastic	3	3
waste ceramic	38	47
waste textile	2	2
waste glass	2	2

3.4 Recycled Aggregate Quality Certification

Recycled Aggregate Quality Certification is authorizing certification system for recycled aggregate manufacturer and companies under the Article 36 of 'Act for

promoting construction wastes recycle in December, 2003' in the Ministry of Construction and Transportation. It aims promoting recycling system in the construction wastes side.

3.5 Recycled Resource Products Certification System

Recycled Resource Products Certification System authorizes Good Recycle Mark (GR mark) to excellent recycled products developed and manufactured in Korea with strict analysis and assessment. Objectives of this system are promoting manufacture using recycled contents and recycling products, and then achieving global environmental preservation and re-creating resources effect. This system is also decreasing environmental load by recycling wastes like Recycled aggregate quality certification.

TableVI: Recycled resource products certification system

building material	certificated companies	Certificated products
floor material	37	62
wallpaper	24	46
panel	32	39
adhesive	105	232
paint	42	122
etc.	66	112

3.6 Analysis on environmental systems of building materials

As a result from each system analysis, most efficient methods to classify environmental building materials are Environmental Label(TYPE 1) and Environmental Performance Declaration System(TYPE 3). The main objective of Group Quality Certification System for environmental building materials is improving indoor air quality so that it has limitation to achieve global environment and healthy residence. Also, Recycled

Aggregate Quality Certification and GR mark has weak meaning of environmental materials due to their focusing on a single aspect like recycling wastes. Environmental Label(TYPE 1) and Environmental Performance Declaration System(TYPE 3) are possible to ensure more confidence than the other systems which decide environmental materials considering whole life cycle stages of products. However, Environmental Performance Declaration System is more excellent in confidence because Environmental Label is not a quantitative assessment method. Environmental Performance Declaration System(TYPE 3) has a weak point on popular use from it's complexity of method although it has high confidence because it is assessed quantitatively from whole life cycle stages as manufacturing, using, and disposal of products. TYPE 3 is expected to assess quantitative environmental impacts on building materials and buildings as a confident system when it obtains popularization and simplicity.

4. DIRECTION FOR TYPE3 CERTIFICATION SYSTEM OF BUILDING MATERIALS

4.1 LCA methodology

The procedure for Type3 is using LCA. (see Figure 2) Life Cycle Inventory DB should be established and LCIA(Life Cycle Inventory Assessment) should be performed by ISO 14000's LCA methodology. After then, environmental building materials are possible to be evaluated for TYPE 3(EPD).

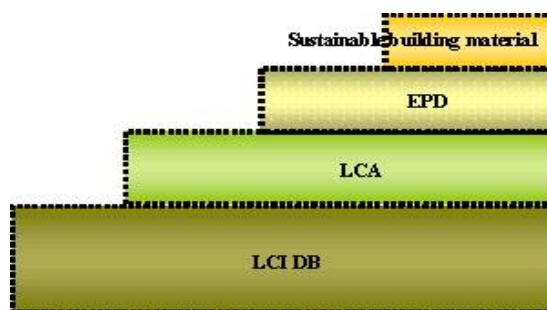


Figure2: Stages for quantitative environmental assessment

4.2 Present state of domestic LCI DB of building materials

National LCI DB on building field have been established as 86 modules which are 62 modules from Ministry of Construction & Transportation, 13 modules from Ministry of Commerce, Industry and Energy, and 11 modules from Ministry of Environment. It is expected that comparing assessment for environmental building materials and preparing basis to use more environmental building materials are possible using LCI DB. Present 86 modules are not enough to assess LCA on one building unit, but expanding LCI DB inventory of building materials and assessing environmental impact of the buildings through Type3 certification could be possible.

4.3 Direction for Type3 certification system of building materials

In the building sector, TYPE 3 is recognized as not popular system, and establishing National LCI DB of building materials is also on the early stage. To support TYPE 3 program which provides quantitative information, preparing positive opportunities for the companies are needed in utilizing National LCI DB.

To achieve this, firstly, a software using National LCI DB of building materials easily is needed to be developed. The existing LCA S/W which is used on general products (Ex. Pass / Ministry of Environment, TOTAL / Ministry of Commerce, Industry and Energy) is not easy tools for non-specialized LCA users, and it does not reflect specific characteristics of building materials. Therefore, easy selection and use for environmental building material should be promoted through S/W development which is possible to compare and assess environmental information of building materials. Secondly, information establishment is needed which is possible to offer information to manufacturer, end-user and consumer. Various levels of education and PR should be done to understand and apply LCA methodology for building specialist and non-specialized user. Thirdly,

environmental performance assessment method should be established by a quantitative methodology on building stages. Building materials are basic components of the building and it affects the overall performance of building itself. Therefore, continuous development of LCI DB of building materials should be proceed.

5. CONCLUSION

Environmental assessment systems operated in Korea are Environmental Label(TYPE1), Environmental Performance Declaration System(TYPE 3), Recycled Aggregate Quality Certification, and Recycled Resource Products Certification System, etc. However, another program to decide the quantitative environmental information of building materials is needed because the existing systems for environmental choice don't deal with overall aspects. Therefore, TYPE3 system which is possible to assess global environmental impact, region environment, and indoor environment based on quantitative data from LCI DB with LCA methodology need to be modified for building products.

The system is not being used in Korea because of ensuring data and complexity of assessing procedure and methodology, but it is widely used for assessing building materials in developed countries. Therefore, introducing and expanding TYPE 3 certification programs should be done with developing LCI DB of building materials.

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