An approach for an Eco-Management and Audit Scheme (EMAS) for the Construction Sector

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Summary

The EU construction sector consumes 42% of the total final energy and is responsible for about 35% of greenhouse gas emissions. It is predominately characterised by SMEs (99.9%). Nevertheless only a small amount of enterprises and thereof very little SMEs have implemented an environmental management system (EMS), such as the EU Eco-Management Audit Scheme (EMAS). Several studies identified certain barriers for SMEs regarding the implementation of EMS. A sector-specific guideline on the subject of EMS for the construction sector is needed, which helps to overcome these barriers. The structure and characteristics of such a guideline is provided, which considers the different stakeholders, phases and activities of the sector.

Keywords: construction, environmental management system, Eco-Management Audit Scheme (EMAS)

1. Introduction

The EU Eco-Management Audit Scheme (EMAS) is a voluntary environmental management system (EMS) for companies and organisations. Initially developed in 1993 it aims at evaluating, reporting and enhancing the environmental performance of enterprises [1]. The scheme was first limited to the industrial sector but was then opened to all economic sectors in a first revision in 2001 (so-called EMAS II) [2]. A second revision in 2010 (EMAS III) aims at increasing EMAS certification of small and medium-sized enterprises (SMEs) [3] which are numerous in the EU and have a high impact on the environment [3]. The development of sector-specific documents with best environmental practices and guidelines as well as a reduction of burdens and costs for SMEs [2] are foreseen measures in EMAS III to foster the certification of SMEs.

The construction sector, which on the one hand plays an important role for the EU economy and which on the other hand has a great impact on the environment, is predominately characterised by SMEs [4],[5],[6]. Whereas there is a rich literature about environmental management systems and linked drivers and barriers for SMEs in general, nearly no sector specific analyses had been performed [3],[7],[8],[9]. For the construction sector such analyses focus on larger construction companies, e.g. [10],[11],[12]. Literature on construction SMEs and their specific needs and requirements of the construction sector in connection to environmental management systems is scarce.

In the following the construction sector, its characteristics and its economic and environmental

relevance are described. Background information about EMAS and the actual repartition of EMAS implementations in companies related to construction is provided. Opportunities and challenges for the development of a construction sector-specific approach in connection to EMAS III are deduced.

2. The construction sector in the EU

2.1 Economic and environmental relevance

With an employment of 14.8 million people and about 7% of the total workforce in 2007 the construction sector is the largest industrial employer in the EU and generated 10% of the GDP [6],[13]. The 3.1 million enterprises of the construction sector are predominately small and medium sized enterprises (SMEs) acting on a local and regional market. 99.9% of them have less than 250 employees [4] and 72.1% of the workforce was employed in micro and small enterprises with less than 50 employees in 2006, which is a much higher share than in other non-financial business sectors [13],[14],[15]. The construction sector includes all the activities over the life cycle of a building/structure, ranging from the construction, over the usage stage to the end of life stage. According to the revision 2 of the General Industrial Classification of Economic Activities in the European Communities (NACE Rev. 2) construction activities (Section F) range from “construction of buildings” (NACE 41), “civil engineering” (NACE 42) to “specialised construction activities” (NACE 43) [16].

Besides this great economic importance, the construction sector and their products have a large impact on the environment. For instance, buildings consume 42% of the total final energy and are linked to about 35% of the greenhouse gas emissions [6]. Furthermore, the construction sector consumes a great amount of raw materials and is connected to high share of the total waste generation. For example, for building materials and products more than 50% of all extracted materials is consumed and despite progress in recycling construction and demolition waste account for about 22wt.-% of all wastes. Further significant impacts of the sector on the environment include water consumption, odour and noise emissions as well as land use [5]. Construction activities generate major environmental impacts in all life cycle stages. As the activities are diverse, the related impacts on the environment are as well. In the building planning stage key aspects are fixed through the building design, such as the choice of materials, applied construction methods, quality of the building envelope, planning for daylight use and easy maintenance, which predetermine the environmental performance during the later life cycle stages.

2.2 Construction stages, activities and involved stakeholders

To establish a sector specific guideline for environmental management, the construction sector needs to be analysed in detail. In *Table 1* different life cycle stages of a structure, related construction activities and involved stakeholders in each stage are outlined.

Table 1 Construction stages, involved stakeholders and related major activities[1] (adapted from [17],[18])

#	Phase description	Involved stakeholders	Major activity groups	Major direct environmental impacts
1	**Land use planning, design**	• Project developers • Urban planners • Architects • Engineers/ structural designers • Consultants of real estate owners	• Building/structure location • Buliding/structure design • Statics	• Through location selection, design and statics major conditions for limited environmental impacts in the following three phases are set
2	**Construction process**	• Construction companies • Craftsmen	• Buliding/structure construction (envelop, interior, electicity)	• Consumption of raw materials, energy, water and ground water • Pollutions of the air, water, ground water and waste generation
3	**Usage, maintenance**	• Facility management companies • Real estate owners • Users • Construction companies • Craftsmen	• Buliding/structure operation (heating, electricity, cleaning) • Maintenance • Refurbishment	• Consumption of energy and water • Pollutions of the air, water, ground water and waste generation
4	**Deconstruction**	• (De-)construction companies • Recycling companies	• Buliding/structur deconstruction • Waste disposal and recycling	• Consumption of energy and water • Pollutions of the air, water, ground water and waste generation

3. Environmental management systems (EMS)

3.1 Background and regulatory framework

EMAS and the international standard ISO 14001 for environmental management have some elements in common. Both share the same objective and each EMAS certified enterprise fulfils the conditions of ISO 14001 [1]. EMAS sets, however, further requirements, for instance the active involvement of employees, continuous improvement of the environmental performance and the publication of an environmental statement to make the environmental performance transparent [2],[3]. Originally both systems, ISO 14001 and EMAS, were designed for large companies and did not consider SMEs [9]. Present developments, such as EMAS III and a handbook with checklists, as a guideline, which should make it easier for SMEs to implement ISO14001, show that the importance of the environmental performance of SMEs is recognised [2],[19].

3.2 Barriers of implementing EMS for SMEs

Several studies were performed on practical experiences regarding the implementation of EMSs in SMEs of different sectors. The three major internal aspects hindering the realisation of environmental practices identified in these studies are [9],[7]:

[1] Personal communication by Thomas Lützkendorf.

- General characteristics of SMEs, such as the heterogeneous nature, the size and limited managerial capacity (e.g., for environmental training and to develop skills in this area).

- Availability and lack of resources, such as workforce, time and capital, as the management of environmental issues is not the core business and related return of investment is not certain and not transparent.

- The personal interest and/or knowledge of company owner/manager in good environmental performance practices.

These aspects or parts thereof are also closely linked to each other.

In terms of external influences, the legal framework and customer demand regarding environmental aspects were identified as the main drivers for improved environmental performance and implementation of EMSs for SMEs. The interest of customers in environmental issues is sometimes low making it not a major driver for environmental activities in SMEs. On the one hand high certification charges in combination with low quality in consulting and inconsistencies in the certification systems are reported as significant barriers. On the other hand the studies reveal that financial resources within the management process are less relevant, and that there is a lack in human resources [3],[9].

3.3 EMAS repartition in the construction sector

Studies show that in general only a small share of SMEs have implemented formal EMS, such as EMAS and ISO 14001 [7]. Related barriers were described under 3.2. In the following the repartition of EMAS in the construction sector in Europe is analysed.
In total there were 4542 EMAS registered organisations at the end of 2010 in the EU [2]. The share of SMEs among the EMAS certified enterprises is with 80% [1] considerably lower than the share of SMEs with 99.8% in EU-27 in 2007 [20]. 172 of all 4129 EMAS-registered organisations in 2008 belong to the construction sector, encompassing 257 sites and 18,765 employees. As shown in *Figure 1* below, around 85% of these registered organisations of the construction sector are SMEs [17]. For mico-enterprises with less than 10 employees, which represent about 92% of all enterprises in construction sector in 2007 [15], the share is even lower showing that there are certain barriers for implementing EMAS [21].

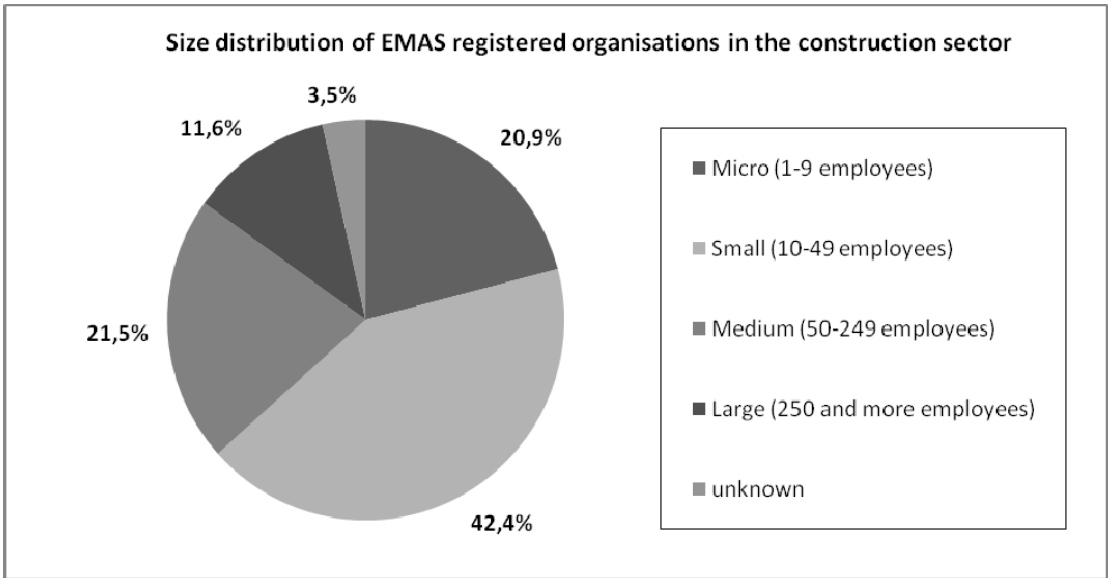

Figure 1 Size of EMAS registered organisations in the construction sector in the EU-27 (according to [17])

4. An EMAS reference document for the construction sector

4.1 Framework and structure of the document

Article 46(1) of EMAS III regulation demands the development of sectoral reference documents for EMAS, which shall include best environmental management practices, sector specific environmental performance indicators and where appropriate benchmarks [22]. According to article 46(3) the European Commission provides a list of sectors for which sectoral and cross-sectoral reference documents shall be developed [22]. Besides construction, retail trade, tourism and public administration have been identified for pilot documents. The general structure of these documents follows the structure of the Best Available Techniques Reference Documents (BREFs), which have been developed under the EU Integrated Pollution Prevention and Control Directive (2008/1/EC) for a number of industrial sectors (cf. [23],[24]). *Table 2* shows this preliminary general structure of these reference documents, which is not totally fixed yet and might change to some extent in the future.

Table 2 General structure of sectoral reference documents (according to [25])

Key structure elements	Defined content structure
Executive summary	
Preface	• Document status • Relevant legal background • Document objective • Sounce of information • Understanding and use of the document • Environmental indicators and benchmarks
Scope	
General information	• Economic data • Environmental issues • Current policies and practices regarding environmental and sustainable aspects • EMAS-repartition in the sector
Available techniques reflecting Best Practice	• Technique description • Achieved environmental benefits • Environmental indicators • Cross-media effects • Operational data • Applicability • Economics • Driving forces for the implementation • Reference organisations • Reference literature
Emerging techniques/approaches	
Conclusion	

The heterogeneous nature of the construction sector, described by the variety of different stakeholders with diverse interests, involved in multiple activities and construction life cycle stages is very challenging for the development of such a reference document. In particular, it is difficult to generalise the direct and indirect environmental impacts of the sector, to develop common strategies and to communicate them target specific [3].

First, the main structure of such a document needs to be determined by splitting the whole construction sector into sections. There are three main possibilities: according to the life cycle stages, to the construction activity types or to the stakeholders involved in construction activities. In all three cases there will be intersections between the sections regarding impacts on the environment. As stakeholders of the construction sector usually perform a range of different construction activities and this range differs from organisation to organisation, a clear allocation to a certain stakeholder group might be difficult. The range of construction activities is very wide and therefore too voluminous to provide a transparent and clear guideline structure. As shown in *Table 1* there is a number of life cycle stages and most stakeholders as well as construction activities can be assigned to one or several stages. Therefore, a general structure following the life cycle stages seems adequate.

4.2 Characteristics of the reference document

The reference document has to address the environmental aspects and impacts related to certain activities in each life cycle stage and needs to provide measures to individual stakeholders to reduce these aspects. To overcome the barriers SMEs have with the implementation of EMS in general, detected in 3.2, the sector specific guideline and provided measures should consider and include the following major characteristics:

- The description of options should be:
  - clear
  - in detail
  - and easy to understand,

  so that they can be performed with the knowledge of an semi-skilled worker without required extra help and as little as much expenditure of time.

- Additionally, the description should include detailed information about required time, human resources and expenses.

- If nevertheless help is required, the guideline should provide contact details for free support connected to each measure.

- For each measure, if available, the organisational benefits, such as return of investment as well as customer benefits should be pointed out and a proposal how to communicate these customer benefits.

Furthermore sector-specific standardised indicators of significant environmental aspects, such as energy and material efficiency, emissions and waste and water consumption, make environmental improvements quantifiable and transparent. The integration of these indicators in the reference document allows SMEs measuring their own environmental performance and benchmarks within the company over time, compared to other companies within the sector as well as positioning their performances with respect to best practises [26].

5. Conclusion

Significant barriers exist for implementation of EMS for SMEs, which can be partly reduced with the help of the here identified major characteristics of a guideline and included measures.

Further research is needed in the field of SMEs in the construction sector and the attitudes of their owners/managers towards the implementation of formal EMS, their concerns and recognised barriers as well as their expected benefits. A Europe wide survey on the basis of those performed with SMEs, mentioned in the present paper, might provide the required information in this case.

6. References

[1] EMAS: “Eco-Management and Audit Scheme”. Online under: http://www.emas.de/, accessed 07.01.2011.

[2] EUROPEAN COMMISSION (2011): “EMAS”. Online under: http://ec.europa.eu/environment/emas/index_en.htm, accessed 06.02.2011.

[3] HILLARY, R., “Environmental management systems and the smaller enterprise”, *Journal of cleaner production*, Vol. 12, 2004, pp. 561-569.

[4] SCHMIEMANN, M., “Unternehmen nach Größenklassen – Überblick über KMU in der EU”, eurostat statistics in focus, 31/2008.

[5] EUROPEAN CONSTRUCTION TECHNOLOGY PLATFORM (ECTP): “Strategic Research Agenda for the European Construction Sector, achieving a sustainable and competitive construction sector by 2030”. Online under: http://cordis.europa.eu/technology-platforms/pdf/ectp2.pdf, 2005.

[6] EUROPEAN COMMISSION (2007): “A lead market initiative for Europe”. COM(2007) 860 final.

[7] MCKEIVER C., GADENNE D., “Environmental management systems in small and medium businesses” *International Small Business Journal*, Vol. 23, 2005, pp. 513-537

[8] WILLIAMS H., VAN HOOYDONK A., DINGLE P., ANNADALE D., “Developing tailored environmental management systems for small business”, *Eco-management and Auditing*, Vol. 7, 2000, pp. 106-113.

[9] WALKER B., REDMOND J., SHERIDAN L., WANG C., GOEFT U., “Small and medium enterprises and the environment: barriers, drivers, innovation and best practice – A review of the literature”, swan catchment council, small and medium enterprise research centre, 03.2008.

[10] LAM P.T.I, CHAN E.H.W., CHAU C.K., POON C.S., CHUN K.P., “Environmental management system vs. green specifications: How do they complement each other in the construction industry?”, *Journal of Environmental Management*, Vol. 92, 2011, pp. 788-795.

[11] OFORI G., GANG G., BRIFFETT C., “Implementing environmental management systems in construction: lessons from quality systems”, *Building and Environment*, Vol. 37, 2002, pp.1397-1407.

[12] TAM V.W.Y., TAM C.M., ZENG S.X., CHAN K.K., “Environmental performance measurement indicators in construction”, *Building and Environment*, Vol. 41, 2006, pp. 164-173.

[13] EUROSTAT (2011a): “Construction sector statistics”. Online under: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Construction_sector_statistics, accessed 03.03.2011.

[14] STAWIŃSKA, A., “The EU-27 construction sector: from boom to gloom”, eurostat statistics in focus, 07/2010.

[15] EUROSTAT (2011b): Online under: Statistiken - Datenbank. http://epp.eurostat.ec.europa.eu/portal/page/portal/european_business/data/database, accessed 21.03.2011.

[16] EUROSTAT (2008): “NACE Rev. 2 – Statistical classification of economic activities in the European Community”, eurostat, European Commission, 2008.

[17] SCHULTMANN F., HIETE M., KÜHLEN A., LUDWIG J., SCHULTE BEERBÜHL S., STENGEL J., VANNIEUWENHUYSE M., „Collection of background information for the development of EMAS pilot reference sectoral documents – the construction sector”. Unpublished.

[18] SCHULTMANN F., SUNKE N., KRÜGER P. K. (2009), „Global performance assessment of buildings: A critical discussion of its meaningfulness“. In: CIB 2009, 3rd International Conference on smart and sustainable build environments (SASBE 2009), Delft University of Technology, Delft, The Netherlands, 15-19.06.2009, 8 pp.

[19] ISO (2011): “New ISO/ITC handbook/CD package puts ISO 14001 within easier reach of SMEs”. Online under: http://www.iso.org/iso/pressrelease.htm?refid=Ref1389, accessed 10.03.2011.

[20] EUROSTAT POCKETBOOKS (2010): “Key figures on European business - with a special feature on the recession”, eurostat pocketbooks, European Union, 2010.

[21] EMASREGISTER (2011), Online under: http://www.emas-register.eu/, accessed 10.03.2010.

[22] EC No. 1221/2009 (2009), “Regulation (EC) No 1221/2009 of the European Parliament and the Council of 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS), repealing Regulation (EC) No. 761/2001 and Communication Decisions 2001/681/EC and 2006/193/EC”. Online under: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009R1221:EN:NOT, accessed 13.12.2011.
[23] IPTS (2011), “Reference documents”. Online under: http://eippcb.jrc.es/reference/, accessed 13.04.2011.
[24] SCHOENBERGER, H. (2009), “Integrated pollution prevention and control in large industrial installations on the basis of best available techniques – The Sevilla Process”, Journal of clean production, Vol. 17, No. 16, 2009, pp. 1526-1529.
[25] SCHOENBERGER, H. (2010), “Sectoral reference documents on best environmental management practice”. International Conference on EMAS on 25 November 2010 in Brussels”. Online under: http://ec.europa.eu/environment/emas/pdf/events/Session%203/4.EMAS_conference_2010-11-25_Harald%20Schoenberger_IPTS.pdf, accessed 13.04.2011.
[26] ZIPPEL, E., “Systematic environmental management – creating added value with EMAS – the difference between EMAS and ISO 14001”, German EMAS Advisory Board – Office: Moosmayer V., Zippel E., Lodigiani M, Koch C., Berlin, 02.2011. Online under: http://www.emas.de/fileadmin/user_upload/06_service/PDF-Dateien/Creating_Added_Value_with_EMAS.pdf, accessed 14.04.2011.