RIMAS Working Papers, No. 1/2011

CSR Activities and Impacts of the Construction Sector

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Sector profile based on a literature review
developed in the course of the FP7 Project
IMPACT - Impact Measurement and Performance Analysis of CSR

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Keywords:

literature review, sector profile, construction sector, CSR, sustainable development, competitiveness, quality of jobs

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Acknowledgements:

The authors would like to thank Katrin Lepuschitz for preparing valuable background information during this study and Megan Ahearn for proofreading.

RIMAS Working Papers aim at stimulating the scientific debate about Corporate Sustainability and Sustainable Development Policies. They are the outcome of ongoing research activities at the Research Institute for Managing Sustainability at Vienna University of Economics and Business. They present preliminary results, which are open for debate and improvement for publication in scientific journals. All comments and suggestions are warmly welcome. The RIMAS Working Paper Series is edited by André Martinuzzi, head of the Research Institute for Managing Sustainability (andre.martinuzzi@wu.ac.at)

1. Abstract

The construction sector is characterized by the temporal character of a construction site (and the high number and diversity of companies involved), by fierce price competition, by high labour intensity (with short-term labour contracts, seasonal work and wage dumping), by the outstanding role of public procurement, and by the long lifetime of the end product (with the respective effects on energy consumption, health of residents, etc.).

The most important issues concerning quality of jobs in the construction sector are health and working conditions (bad physical working conditions, long and unfavourable working hours, high accident rates and work-related illnesses) and flexibility, stability and security, especially further down the subcontracting chain, where limited contracts, wage dumping, leasing, and sometimes illegal practices are common.

As construction remains primarily a local industry with a majority of small and medium-sized enterprises, the competition with companies outside Europe is negligible. The construction sector suffered from the economic crisis all across Europe: Mainly the United Kingdom, Ireland, Spain, Denmark, and the three Baltic countries experienced the consequences of bursting bubbles in the housing markets. With the exception of the United Kingdom, the pre-crisis development in those countries was also characterized by a construction boom, later followed by a deep bust. As a consequence, the construction sector was the focus of economic stimulus packages in many countries, as public investments in infrastructure are regarded as very effective on the labour market.

Five actors play a prominent role in shaping the environmental and societal impacts of construction on the one hand, and deciding on its cost structure on the other: the property developer, the general contractor, the investor, and the future user and owner. Only if at least one of these key actors requires them, CSR measures are implemented. If none of them perceives CSR measures are essential, societal responsibility is seen in contradiction to the high pressure for low costs, which are the most decisive factor for competitiveness in the construction sector.

CSR activities in the construction sector focus on occupational health, security and safety on the one hand, and on sustainable construction and accordingly eco-compatible buildings on the other. Public CSR policies in the construction sector should set a good example in public procurement processes, establish standards (e.g. for energy consumption), enforce the implementation of existing norms and regulations (e.g. occupational health and safety), and combat corruption.

2. Facts and figures

The European Construction industry is one of the largest industries in Europe. Its significance lies in providing the infrastructure for other sectors - for this reason the sector is also often used as an indicator for the overall state of economy. Small and medium sized enterprises make up the largest number of construction companies, while the sector is also characterised by high labour intensity. The construction sector is the largest industrial employer in Europe.

According to the European Construction Industry Federation (FIEC, 2009, p.3), the construction sector accounts for 10.4 % of the GDP in 2008. With 16.3 million operatives the construction sector is responsible for 7.6 % of Europe's total employment and 30% of industrial employment, making construction the biggest industrial employer in Europe (FIEC, 2009, p.3). Three million enterprises are active in the construction sector, whereby 95% are SMEs with fewer than 20 operatives and 93% with less that 10 (FIEC, 2009, p.3). In comparison to other sectors, public procurement is very important for the construction sector and public investment has a major influence on the cyclical stabilisation of the sector.

The construction sector embraces the following larger subsectors as divided according to NACE 2.0 code (group F)[1]

- Construction of buildings (Development of building projects, construction of residential and non-residential buildings)
- Civil engineering (Construction of roads and railways, construction of utility projects, construction of other civil engineering projects)
- Specialised construction activities (Demolition and site preparation, electrical, plumbing and other construction installation activities, building completion and finishing, other specialised construction activities)

The size of each of these subsectors (broken down further) according to value added and employment share is depicted in the table 1 below:

1 Full list of NACE codes available on: http://ec.europa.eu/competition/mergers/cases/index/nace_all.html

Construction sub-sectors in Europe	**Share of sector employment (2006)**	**Share of sector value added (2006)**
General construction: construction of complete buildings (or parts of thereof) and civil engineering construction of highways, airfields, sport facilities, construction of water projects	55 %	58,8 %
Building installation: installation of electrical wiring and fittings, insulation work activities, plumbing and other building installation	23,6 %	22,%
Building completion: plastering, joinery installation, floor and wall covering, painting and other building completion	17,7 %	14,9 %
Site preparation: demolition and wrecking of buildings, test drilling	3,1 %	3,4 %
Renting of construction or demolition equipment with an operator	0,6 %	0,8 %

Table 1: Construction sector: Importance of sub-sectors. Source: Eurostat (2010, p.3)

As table 1 shows, general construction, building installation and building completion are the most important sub-sectors in terms of the share of sector employment and the share of sector value added in Europe. The countries with the largest share of construction sales are Germany (18%), Spain (15%), France (13%), United Kingdom (12%), and Italy (12%) (see figure 1). Almost all of these countries are also home to the biggest European Construction companies (See Annex 2).

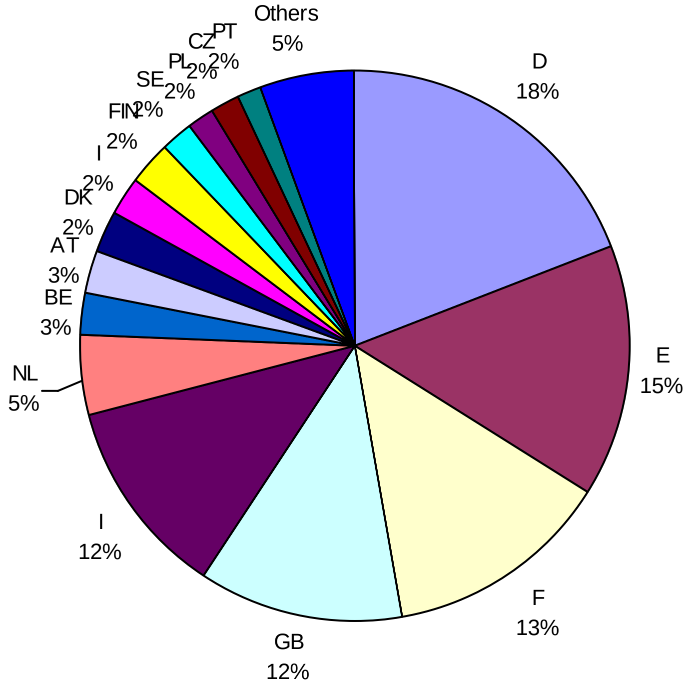

Figure 1: Country share % of total European construction companies' turnover (2008). Source: FIEC 2009

Sector employment: With more than 15 million workers, the construction industry is the largest industrial employer in Europe, responsible for 30% industrial employment. However, the economic crisis has affected employment figures as well: For the first time in a decade, employment has decreased, -1,7% in 2008 (FIEC, 2009). Table 3 shows total construction employment in 27 EU Member States (FIEC, 2009).

Country	Thousands of units 2009	% change from previous year
AT	258	-1.9
BE	253	-1.8
BG	266	-7.3
CY	41	-4.7
CZ	430	-2.3
DE	2,150	-2.3
DK	167	-7.5
EE	NA	NA
ES	2,073	-13.3
FI	170	-11.0
FR	1,926	-1.2
GB	2,241	-0.5
GR	300	-2.6
HU	241	-20.1
IE	190	-26.1
IT	1,840	-6.6
LT	106	-37.2
NL	468	-1.3
PL	610	3.4
PT	563	0.5
RO	440	4.8
SE	275	-10.1
SI	80	-8.0
EU	**15,086**	**-5.1**

Table 2: EU 27 Construction employment and effects of crisis. Source: FIEC (2009).

3. Growth and competitiveness

Sector growth: As a result of the financial crisis, the European construction sector experiences stagnation or even reduction: residential buildings (47 % of the construction market Volume, 2007) are expected to decrease, and for non-residential buildings (32 % of the construction market Volume, 2007) and civil engineering (21 % of the construction market Volume, 2007) a slight increase is expected (Dorffmeister, 2008, p.27). The views on possible recovery remain rather pessimistic (European Commission, 2010). Compared with July 2008, output in July 2009 dropped by 10.8% in the Euro area and by 11.1% in the EU27 (Eurostat, 2009). The situation varies significantly between countries and subsectors. Eastern European countries have been hit less severely, while western countries like Spain, Ireland and UK have been hit the worst. Moreover, the crisis has especially affected SMEs due to their heavy reliance on bank lending, which made them more exposed to late payments by clients. According to Federation Internationale Europeene de la Construction (FIEC) classification, house building is in an even deeper downturn, whereas non-residential building (normally influenced by business climate) is now mainly sustained by public building investment. The same can be observed for engineering works, while private non-residential is suffering more. The only subsector, according to FIEC, with a positive growth rate is rehabilitation and maintenance works (FIEC, 2009).

Sector competitiveness: The European Commission has expressed its commitment to developing an ongoing competitiveness strategy for the construction sector. It states that the competitiveness of the European Construction sector relies on the following factors:

- the commitment of market operators towards a better quality policy;
- sustainable development objectives;
- research and innovation activities;
- improved skills and qualifications of its workforce and management. (European Commission, 2009b)

In terms of specific actions, the European Construction Technology Platform (ECTP), launched in 2004, is one of the main initiatives taken by the European Commission to maintain the construction industry’s competitiveness. It focuses on analysing the major challenges faced by the sector in terms of societal, economical, and environmental developments, and on the development of research and innovation strategies for the sector to deal with these issues. Moreover, sustainable construction is one of the EU LEAD market initiatives, with the aim to foster innovation and sustainable construction by providing a coherent basis of regulations, standardisation, and public procurement as well as upgrading skills of construction workers (European Commission, 2009b) for a key competitive market.

The following table 4 shows the critical success factors for construction sector's competitiveness:

Critical Success Factors – Construction Sector	**Authors and year**
Timely completion, profit, programme/planning, cash flow, management level leadership	Ng et al., 2009
Business management, financial conditions, quality of work and workmanship, sales and marketing, use of technology, market selection, and owner-manager characteristics.	Arslan, Kivrak, 2008
Integration of standards-based management systems, health standards, environmental management	Griffith, Bhutto, 2008
Comprehension, competence, commitment, and communication	Toor, Ogunlana, 2008
Partnering: collaborative team culture, a long-term quality focus, consistent objectives, resource-sharing	Chen, Chen, 2007
Development of partnerships with sub-contractors, efficient supply chain management, quality, cost, service, concurrent engineering	Errasti et al., 2006
Cost, schedule, quality and relationship	Jin, Yean Yng Ling 2005
Innovation, good contract negotiations	Egbu, 2004
The role of the owner/manager, investments in intellectual capital, investments in information and communication technology, and the ability to adapt to change	Love, Irani, 2004
Innovation and corporate governance	Miozzo, Dewick, 2002
Quality of workmanship, honesty, having good employees, and completing projects on time	Hutchings, Christofferson, 2001
Cost advantage, entrepreneurial variables, the existence of a dynamic home market, and cultural proximity to several emerging markets	Oz, 2001
Price, time	Ball et al., 2000; Hughe et al., 2004
Safety, training and education	Bednarz, 1997; Gordon, 1997
Five groups of success factors in the construction industry: human related factors, project related factors, projects procedures, project management actions, and external environment	Chan et al., 2004
IT implementation	The Latham Report (1994)

Table 3: Construction sector: literature on critical success factors

Cost, time, and quality are very often perceived as traditional success parameters in this sector (Ball et al., 2000; Hughe et al., 2004). Ball et al. (2000) underlined that the economic performance of construction companies correlates positively with the construction business cycle.

Most of the literature conducted on critical success factors in the construction industry focus on construction projects from the point of view of the project management (Toor, Ogunlana, 2008), where cost, time, and quality play the major role. Other studies have picked success factors in sub-contracting relationships (Errasti et al., 2006; Ng, Tang, 2009) or sub-contracting firms themselves (Ng, Tang et al., 2009). Arslan et al. (2008) explain this trend through the importance of the ability to plan and execute projects for success in the construction industry. Chen and Chen (2007) discussed role of partnering as one of the most innovative developments in delivering a project efficiently and reducing construction disputes. They found collaborative team culture to be the most important factor of successful partnering. Collaborative team culture was followed by long-term-quality focus, consistent objectives, and resource sharing.

Toor and Ogunlana (2008) and Arslan et al. (2008) are among the few who have focused on the critical success factors of construction companies as a whole. Toor Toor and Ogunlana (2008) identified relationships with stakeholders as being key, while Arslan et al. (2008) took a much broader view and determined critical success factors in an empirical analysis of 40 Turkish construction firms, namely business management, financial conditions, and owner/manager characteristics.

Griffits and Bhutto (2008), in a study based on the UK, have expanded the debate in arguing that it has become essential for construction contractors to consider environmental aspects of their business in order to remain competitive. They did, however, acknowledge that the construction company's competitiveness remains reliant on cost of building rather than environmental performance.

Egbu (2004) explored the role of knowledge management and intellectual capital in organizations using construction sector as a case study. According to the author, education and training programs for personnel lead to increased innovativeness of the company, which is seen as one of the success factors.

Love and Irani (2004) found that for SMEs within the construction industry, the main competitiveness power relies on the role of the owner/manager, investments in intellectual capital, investments in information and communication technology, and the ability to adapt to change. The importance of IT implementation and its influence on efficiency and productivity in the construction industry was also raised in The Latham Report (1994). According to this report, investment in this area can reduce project costs as much as 30%. Miozzo and Dewick (2002) highlighted the role of innovation and corporate governance for building a competitive advantage in the construction sector.

Some researchers showed that factors related to business success in the construction industry are the control of job-site safety (Gordon, 1997, quoted by Arslan and Kivrak, 2008), and ongoing training and education (Bednarz, 1997). Hutchings and Christofferson (2001) found evidence that among small-volume residential constructors, the most important success factors were quality of workmanship, honesty, having good employees, and completing projects on time.

Chan et al. (2004) distinguished five groups of success factors in the construction industry: human related factors (e.g. personal characteristics of the project team leaders such as technical, planning and organizational skills, the size and nature of the client), project related factors (e.g. type, size, complexity and nature of the project), projects procedures (e.g. procurement method), project management actions (e.g. communication system, control mechanism, implementation of an effective safety programme), and external environment (e.g. industrial relations, economic, social and physical environment).

Oz (2001) discussed cost advantage. Additionally, the author stressed the role of favorable entrepreneurial variables, the existence of a dynamic home market, and cultural proximity to several emerging markets.

Martinuzzi et al. (2010) offered an analysis of CSR-competitiveness at the sectoral level. They concluded that both competitiveness and CSR issues are highly sector specific - these differences cannot be ignored. In case of the construction sector, the most important CSR issues are health and safety conditions, sustainable construction, and anti corruption measures. On the competition side there is fierce price competition, high labour intensity, and a long lifetime of the end product. When trying to verify the relation between CSR and competitiveness in the construction sector, these factors should be analyzed and linked.

4. Environmental issues

Table 4 below summarises environmental issues in the construction industry.

Environmental issues - construction industry	Authors & Year
Reducing emissions of greenhouse gases, moving away from disposal of waste towards waste reduction, recycling and recovery, consumer information, and encouraging movement in the market	Holton et al., 2007
Reducing CO2 emissions, energy-efficiency of residential buildings	Pinkse, Dommisse, 2008
Raw material extraction and consumption, land use change, including clearing of existing flora, energy use and associated emissions of greenhouse gases, aesthetic degradation, water use and waste water generation, increased transport needs,	Sev, 2009
Cultural, social and environmental ramifications around the indicators suggested by Building Research Establishment Environmental	Warnock, 2007

Assessment Method (BREEAM), UK, and Green Building Challenge (GBC), International.	
Consumption of energy and materials, generation of waste and dust, and pollution of air and water, numerous toxic wastes produced during the construction	Son et al., 2009
Resource consumption, environmental loadings	Matar et al., 2008
Human wellbeing (immediate), eco systemic well being (delayed)	Du Plessis, 2007
Enhancing and better protecting the natural environment; and minimising its impact on the consumption of energy (especially carbon-based energy) and natural resources.	Pitt et al., 2009
Minimising waste, to put an end to its appalling record of pollution incidents, to integrate the supply-chain	Myers, 2005
Constructing buildings that are durable and long lasting, making future environment safe, making the materials from sustainable resources	Said et al., 2010
Use of fossil fuels, atmospheric pollution, loss of soil and agricultural land, loss of forests and natural habitats	Spence, Mulligan, 1995
Global warming potential, acidification, photochemical ozone creation, eutrophication, energy consumption, and waste creation	Ortiz et al., 2009
Reuse of materials in the construction industry and using eco-materials	Erlandsson, Levin, 2005
Eco-innovations, 'smart' building materials	Chavan, 2005
Indoor environment, pollutions, and human well being	Arjen et al., 2005
Life cycle assessment of dwellings; about 70-90 % of the environmental pressure stems from the use phase	Adalberth et al., 2001

Table 4: Construction sector: literature on environmental issues

The construction industry has a major effect on sustainable development. Not only does it have some of the biggest direct effects on water, resources, land use, and greenhouse gas emissions (Pinkse, Domisse, 2008; Pitt et al., 2009), and indirect effects on the environment by affecting transport systems, but it also affects communities and even public health (Sev, 2009; Holton et al., 2007). As Pitt et al. (2009) put it, "the built environment affects all human activity". Parallel to that, construction is a major facilitator and contributor to the overall economy. Consequently, construction sector has major impacts on all three pillars of sustainable development: environment, society, and economy (Warnock, 2007; Pitt et al., 2009).

Almost all scholars have focused on the concept of sustainable construction as a sector activity that would address sustainable development issues (Holton et al., 2007; Sev, 2009; Pitt et al,. 2009; du Plessis, 2007; Matar et al., 2008; Son et al., 2009; Warnock, 2007). As Said et al. (2010) suggested, "Sustainable construction is construction that contributes to and upholds sustainable development". Some examples of new, more sustainable approaches to building are: Green Building

Challenge Stockholm, the European project passive house, or the American Off-Grid Zero Emission Buildings.

Du Plesssis (2007), in a study of sustainable construction in developing countries, distinguishes when construction has an effect on sustainable development. In the first instance, Du Plessis separates effects on resources versus effects on human beings (human wellbeing is immediate and about giving more; eco-systemic well being is delayed and about using less), while at a later stage she also argues that construction activities have four layers, in which effects on humans and the environment vary in extent and occurrence. The four levels are: 1) site activity, 2) the comprehensive project cycle, 3) everything related to the business of construction, and 4) the broader process of human settlement creation.

Spence and Mulligan (1995) give a comprehensive overview of all environmental impacts resulting from the construction industry. They are:

- Use of fossil fuels (due to energy use for the production and operation of buildings; The use of energy in the production phase represents only about 10-15 % of the total lifetime energy use),
- Atmospheric pollution (the construction sector is responsible for a large amount of atmospheric pollution resulting from fossil fuel consumption and cement manufacturing. Manufacturing of building materials contributes 8-20 % of total carbon dioxide emissions of the construction sector. The construction sector also contributes to the creation of the ozone depleting gases),
- Loss of soil and agricultural land (activities of quarrying and mining, urbanization, road building, civil engineering projects),
- Loss of forests and natural habitats.

Other authors have focused on the actual effects of construction on sustainable development (Matar et al., 2008; Sev, 2009). Matar et al. (2008) conducted a survey of about 100 publications and produced a comprehensive list of all **effects construction has on sustainable development** to be used in their developed operational context space (OCS) framework. They are depicted in the figure 2 below:

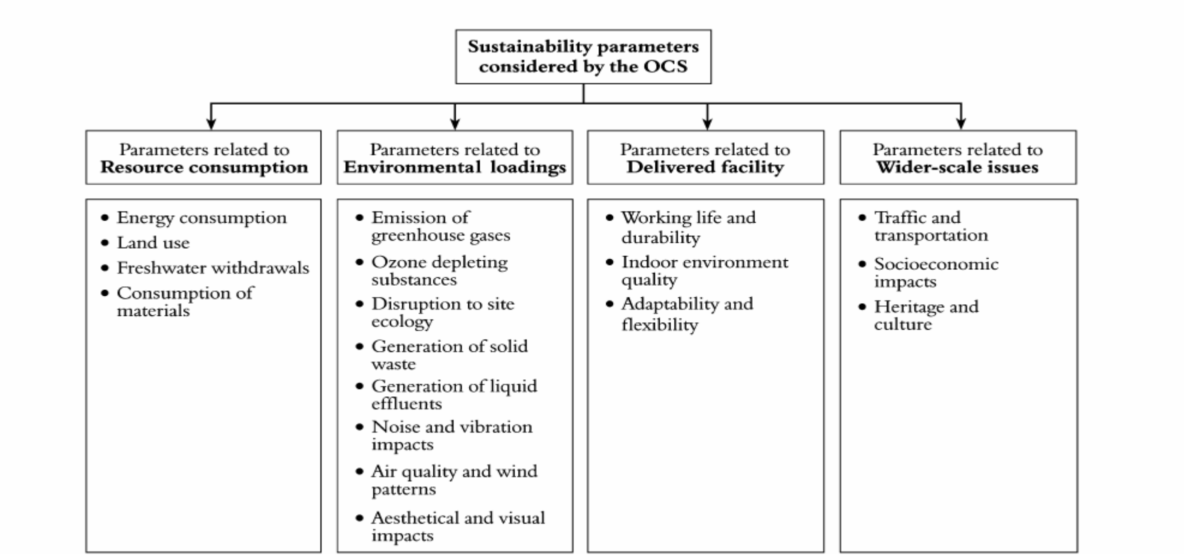

Figure 2: Sustainability performance parameters considered in the OCS.
Source: Matar et al. 2008.

Sev (2009) developed a similar framework centred on the life-cycle of construction, taking into account three factors: resource management, life-cycle design and design for human (see figure 3).

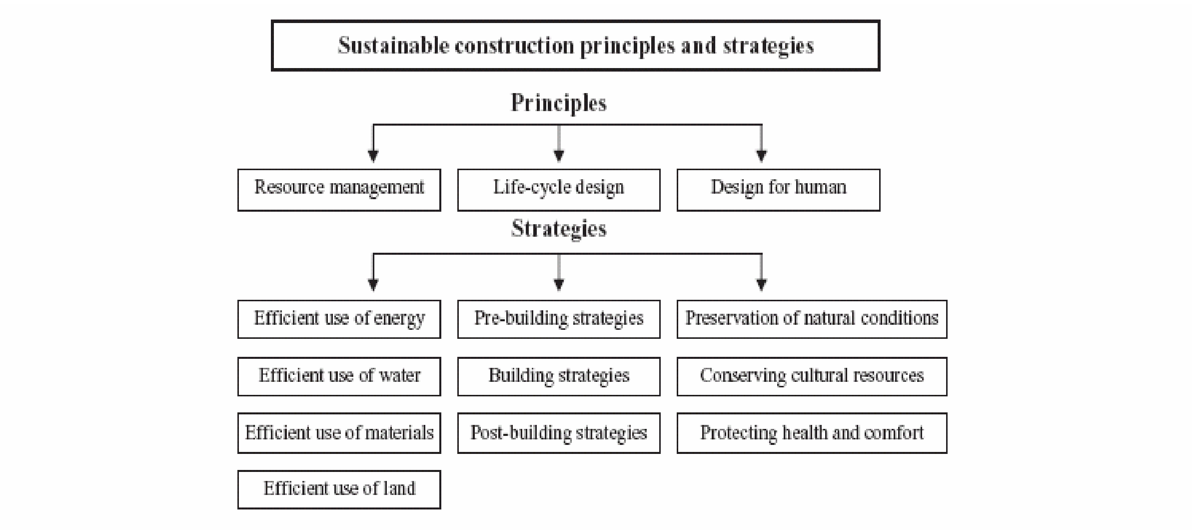

Figure 3: Framework for evaluating sustainability of the construction industry.
Source: Sev 2009.

Sev (2009) also offers a very comprehensive discussion of how construction can contribute to sustainable development, by considering the whole life cycle of buildings and caring for the environment as well as human health and comfort.

Ortiz et al. (2009) gives a comprehensive overview of LCA analysis applied to assess environmental burdens from the construction industry. The most frequently studied issues are: global warming potential, acidification, photochemical ozone creation, eutrophication, energy consumption, and waste creation. However, there are other environmental impacts such as inefficient land use, use of water, deterioration of ecological systems, and human toxicity.

Environmental impacts within the construction process differ between dwellings, commercial buildings, and civil engineering constructions. Adalberth et al. (2001) analyzed the environmental impact within the whole life cycle of dwellings. They found that 70-90 % of the environmental pressure arises during the use phase (assuming 50 years occupation time). About 85 % of energy consumption occurs during this phase, another 15 % is linked with manufacturing phases.

Some studies were also conducted to reveal resource uses from non-residential buildings. They revealed that the operation phase has a higher environmental impact than any other stage of life-cycle. Scheurer et al. (2003) found that in university buildings, the operation phase was responsible for 97,7 % of the primary energy use. Decommissioning, demolition and transport were only responsible for 0,2 % of energy use.

A few scholars analyse the issues in implementing sustainable construction (Myers, 2005; Warnock, 2007), while Pitt et al. (2009) and Holton et al. (2007) suggest that one of the responsibilities of sustainable construction is economic profitability as a response to the economic pillar of sustainable development, while Myers (2005) argues that sustainable construction will have to create its own market demand to become economically viable.

Practitioners and scholars pay increasing attention to reused and eco-materials. Erlandsson and Levin (2005) concluded that rebuilding is better for the environment than constructing buildings from newly produced materials. Thanks to this approach, an adverse environmental burden can be decreased by nearly 70 % for heating and 75 % for the sewage system.

Chavan (2005) suggested to use smart building materials such as titanium dioxide used for cement and concrete products. UV rays hitting titanium dioxide would trigger a catalytic reaction that destroys the molecules of pollutants like nitrogen oxides.

Environmental hazards in the construction industry are also linked with the indoor environment. A study carried out by Arjen et al. (2005) revealed that during the occupation phase, humans are exposed to a harmful environment, namely containaing radon (59 % of total indoor emissions), gamma radiating elements (38,7 %), and formaldehyde, toluene, and others respectively 1,3 %, 0,8 % and 0,2 %.

5. Quality of jobs issues

With EU market opening and public procurement legislation, a distinctive business model emerged: Large European corporations develop property with the help of long and complex subcontracting chains. At the bottom end of the value chain, a large number of SME are under increasing cost pressure (Cremers, 2009). This pattern has shaped working conditions in the sector: Construction work is often called “3D”: dirty, dangerous, degrading. Working conditions tend to vary considerably according to type of job (office or field work) and skill level (the less skilled, the worse; Eurofound 2002). Clarke and Wall (2000) also distinguish between national types of production, distinguishing a “high track” (skilled, regulated, with social partnership) industry and a “low track” (low skilled, precarious) industry.

Table 7 below summarises quality of jobs issues in construction industry and the main concepts found in literature.

Quality of Jobs issues in construction sector	Source
Skills and employability	Cremers, 2009; Nisbet, 2007; Jones et. al., 2006
Equal treatment (gender, minorities, disabled)	Eurofound, 2002; Byrne, 2005; Newton, Ormerod, 2005
Health and working conditions	Moser et al., 1999; Lips 2000 ; Crossley 2002; Merllié, Paoli 2002; Krenn, Vogt, 2004; Eurofound, 2002
Job flexibility, stability and security	Cremers, 2009; Nisbet 2007; Westman et al., 2001
Work-life balance (long, irregular and non standard working hours, relocation and work away from home; part time work)	Lingard, Francis, 2002; Lingard, Francis, 2005; Lingard, Francis, 2005a; Lingard et al., 2008; Fielden, et al. 2001
Workers participation, recognition, team belonging, management commitment and leadership, effective training	Yankov, Kleiner, 2001
Flexible hours, training, childcare facilities, equal opportunities	Fielden et al., 2001
Safety in the workplace, good communication, feedback processes, training, open communication, and empowerment	Petrovic-Lazarevic, 2007
Quality of jobs based on production systems	Clarke, Wall, 2000

Table 5: Construction sector: main literature on quality of work

The following aspects of job quality are predominant in the construction sector:

Health and working conditions are of highest concern. Physical working conditions are worst of all industries, with ½ to ¾ of all workers working under an adverse environment, in painful and tiring positions. Between 54 and 64% of all workers accumulate more than 4 exposures. This trend is worsening. Moser et al. (1999) use the concept of base and peak exposure to explain that many and frequent low exposures accumulate to high risk for accidents and work related illnesses. Using Austrian data, 93 % reported back pain (with 82 % due to work exposure). Working hours are long and unfavourable (Krenn, Vogt, 2004; Lingard, Francis, 2005; Lingard, Francis, 2005a; Lingard et al., 2008;), accident rates are high (more than eight times the average in the UK: Crossley 2002). Work-related illnesses are twice the EU average (Merllié, Paoli 2002). Comparing illnesses of construction workers with the national average, Moser et al. (1999) found worse health figures of construction workers in all cases except for respiratory and skin diseases and infections. Construction has the highest proportion of long-term illnesses causing absences compared to all industries (Vetter et al., 2002). Only a fraction of the workforce reaches regular retirement age without invalidity (Lips 2000 on Swiss data; Moser, 1999 with Austrian data). The risk of premature exit from life due to accidents is twice the average, and the risk for invalidity is more 2,7 times average (Moser et al., 1999).

Flexibility, stability, and security are high issues, as construction work is mostly project-based, fixed-term, and seasonal work. The trend worsens especially when moving further down the subcontracting chain, where limited contracts, wage dumping, leasing, and sometimes illegal practices are common (Cremers, 2009). In some countries, bogus self-employment are on the rise, especially in the deregulated economies like the UK (Nisbet, 2007). Contractual security (indefinite, fixed-term, leasing, or self-employed contracts) is the second highest concern for job satisfaction in the sector (Eurofound, 2002) and has major repercussions on absenteeism, work-related illnesses, family and marital quality, and more (Westman et al., 2001; Lingard, Francis, 2002).

Work-life balance is a relatively young issue due to changing societal patterns: The long-working male employee, sometimes weeks away from home, feeding a family, is part of a traditional family pattern that tends to diminish. The sector does not support flexible family arrangements. Lingard (2002, 2005, 2005a) found with Australian data considerable repercussions of working conditions on marital and family well being, where long working hours are of primary concern. In connection with **wages,** a risk of "working poor" can be observed: lowest qualified jobs tend to be insufficient to feed a whole family, whereas working hours do not support dual earners. Having more children worsens this situation for families (Fielden, et al. 2001; Lingard, Francis, 2002).

Stress and time pressure offers a mixed picture: on the one hand it tends to be a pattern dominant for skilled personnel. With 37% of the workforce feeling stressed, the construction industry has the third worst score in the EU (Merllié, Paoli, 2002). On the other hand, industry observers suggest that this issue is rising due to a reduced workforce and shortened construction timeframe. Moser et al. (1999) found 61 % of their interviewees reporting stress as "frequent", but resulting illnesses as infrequent.

Skills and employability is a blind spot for the industry: Academics and industry observers consider it as an issue: they consider training to be a key success factor of the industry. By contrast, an industry with low wages, low working conditions, and high labour turnover has no incentive to develop intrinsic skills; therefore, industry practitioners do not see skills as an issue. Consequently, the level of HRM is “relatively poor” (Jones et. al., 2006). The skill level is heterogeneous: a small group of skilled specialists and foremen tends to receive more training and higher tenure rewards. A growing crowd of unskilled workers is little or not trained at all (Nisbet, 2007). Main results from this deadlock are little transferability of skills for employees (which lowers employability) and low health and safety awareness. There are considerable national differences to this problem, where the UK is worst due to lack of formal training schemes. Dual training models (like Germany and Austria) do relatively well, as well as formal school-like training systems dominant in Eastern Europe.

Equal treatment in gender as well as other disadvantaged groups also seems to be an issue seen from “outside”, as surveys show little effect on job satisfaction (Merllié, Paoli, 2002). Construction has the highest gender employment gap and a significant gender pay gap compared to EU average, especially in low pay areas (Eurofound, 2002). Strong discrimination can be found concerning ethnic minorities: low skilled, low paid, precarious, and sometimes illegal conditions are overrepresented among migrant communities (Byrne et al., 2005). On disabilities, the sector tends to be one of the major “producers” of disabled persons, but tends to “export” them into other sectors and early retirement (Newton, Ormerod, 2005). Nevertheless, perceived equal treatment is slightly positive compared to other sectors (Eurofound, 2002).

6. CSR issues

Table 6 summarises the most relevant CSR issues derived from literature analysis:

CSR issues – Construction Sector	Authors and year
Feasibility studies and environmental and social performance	Shen et al., 2010
Environment (pollution of air & water, traffic), health & safety (disruption of life-quality), security, community engagement	Glass, Simmonds, 2007
Health & safety (site-based work-family conflict, emotional exhaustion, burnout), fair working hours & adequate compensation (long work hours)	Lingard et al., 2008 Merllié, Paoli, 2002
Training & education (no sufficient trainings due to a high number of self employed workers, skills shortage), gender equality, health & safety, environment (waste, pollution, energy, use of natural resources), sustainable supply chains	Jones et al., 2006
Bribery & corruption (shadow bookkeeping, illegal price agreements, evasion of taxes, development of cartels), sustainable supply chains, stakeholder management	Kolk, Pinkse, 2006
Environment (Energy & Waste), safety, ISO 14001	Wenblad, 2001

Table 6: Construction sector: literature on CSR issues

The studies on most important CSR issues as summarised in Table 6 above do not show a great deal of homogeneity. However, two issues are quite prevalent; namely environmental and health and safety issues (Wenblad, 2001; Jones et al., 2006; Glass, Simmonds, 2007; Shen, 2010).

Kolk and Pinkse (2006) and Glass and Simmonds (2007) focused specifically on stakeholder management and community relations practices respectively within the construction industry through case studies. The latter have identified that often, the employees of construction companies lack knowledge and training when dealing with the community. Lingard et al. (2008) have analysed one specific issue of ethical human resource management from the point of view of the employees.

Two of the studies have pointed out the growing importance of responsible behaviour by construction companies as an integral part of the business or a source of a competitive advantage (Wenblad, 2001; Jones et al., 2006). A case study of the UK construction industry conducted by Jones et al. (2006) indicates that the consideration of CSR can help to reduce costs by reducing energy use, water use, and by applying health and safety measures and training of workers in order to complete contracts on time and to budget. Nevertheless, it is pointed out that due to fierce competition in the construction industry, companies need to balance CSR commitments with their commercial goals (Jones et al., 2006).

7. Trends and Future Prospects

The Construction Sector addresses builders, the production industry, as well as tenants, and consists of the built environment, which implies all human built structures, including buildings, roads, and all other fixtures that form the physical character of a city. Therefore technological, political, economic, and social aspects as well as their interconnectivities, have to be considered within the study of the construction sector's future development. (Bourdeau, 1999)

Along with climate change, its environmental impacts, dwindling natural resources, and changing demographics, new buildings will have to be designed to cope with the effects of global warming, extreme weather conditions, and the changing needs of society. According to Roberts (2008), buildings will have to be as resistant as possible in order to deal with increased subsidence risk, flood risk, winter storm damage, wetter climate or prolonged drought, and increasing temperatures in summer. For instance, in areas prone to flood and storms, homes could be built to be more resistant to natural disasters, and housing design must include a strong wall system. Prevention can also be achieved by building on high ground or on stilts, by accordingly to allow easy drainage and quick drying.

Warmer climate conditions point to the need to limit summertime heat gains. In order to achieve thermal comfort, it is advised to employ solar shading, reduce the density of power output of lights and machines, and provide the ability to reduce ventilation to minimum levels during hot periods of the day while at the same time enabling the spaces to be purged with cool air at night and during periods of cooler weather or through mechanical air conditioning. (Simon, 2008)

However, in order to develop a performance based building regulation which is a prerequisite for reducing the embodied carbon content of construction, it is essential that the industry has standardized climatic data and a standardized methodology for performance prediction. Yet, tools need to be appropriate and take account of future climate factors. There will also be a need for finer-scale spatial and temporal scenario information with enhanced regional and local climate change scenarios, and scaling for global climate scenario information. (Meacham et.al, 2005)

According to Meacham et. al. (2005), further factors should be addressed in building regulations: responding appropriately with building concepts to developing countries and their actual circumstances, needs, limits, and societal desires, which do not always require high technology, but sometimes maybe low- or intermediate technology.

Furthermore new buildings must use less fossil fuel to support the idea of a low or zero-carbon world. For instance, in the UK, buildings account approximately 45% of total energy consumption. Solutions to addressing the challenge of saving energy include low-carbon microgeneration technology, such as ground-coupled heat exchangers and photovoltaic systems – these should be taken into account when constructing new buildings. Microgeneration units operate to match the heat demand of the building, but also generate electricity when necessary. Even though the combination of heat and power sounds favorable, there are some limitations in use regarding the expensive production of photovoltaics and the unpredictable performance of wind in terms of wind turbines. Therefore, the microgeneration technologies closest to being commercially viable are solar water heaters, biomass boilers, and heat pumps that can provide space heating, cooling, and water heating. These technologies still need to be improved though. (Simon, 2008)

Yet, Simon (2008) also claims, that a low-energy designed building can be achieved with thermal insulations, airtight structural details, high-performance windows, ventilation, and heat and cold recovery systems. Life cycle and the use of recyclable material also play an important role within the context of resource efficiency and carbon reduction.

In terms of demographics, Roberts (2008) claim that there is a significant move to single occupancy in Europe, in which per capita energy consumption increases dramatically. For instance, from 1996 and 2050, the average number of people per household is expected to decrease from 2.4 to 2.1. Whereas almost 70% of the expected rise in households numbers between 1992 and 2016 is expected to be in single-person households. Half of them are likely to be pensioners. Therefore, changing demographics are forcing building regulators and constructors to implicit assumptions about population changes and require further research for what population a building should be designed to address also the issue of ageing population.

Ravetz (2008) claims that there will be a distinctive demand on housing until 2050. The following numbers reveal reasons for this argument: the English and Walsh population is forecasted to grow 0.7% per year, whereas household formation is projected to grow about 0.9% per year. As a result, the UK average household size is forecasted to fall from 2.43 to 2.1 persons per household by 2050. That means that households are expected to increase from 25.78 million in 2006 to 31.81 million in 2050. At the same time, the rate of demolition comprises only 0.03% of the total stock. Consequently, the majority of the UK building stock of 2050 exists already today and therefore the subjects of the future are continuous maintenance, upgrading, adaptation, and rehabilitation. In addition, the results show a distinctive trend to continuing expansion of the physical built environment. Hence, the supply side will be facing a major and growing sector of construction industry and a major source of investment and added value.

Concerning consumer demands, there are the following potential trends to be sketched out: dwellings as a technology centre and the integration of IT with domestic technologies, such as video walls, intelligent kitchens, housing adapted to climate change to provide ecological habitats, and outdoor leisure. This development, however, is strongly linked to the ICT sector. In terms of energy efficiency and performance, there is a strong tendency toward new lighting technologies such as low-energy bulbs, domestic air conditioning, and an appliance diversification of new sources of high energy demand, such as patio heaters, wide screen television, clothing driers, advanced security systems, etc. (Harty et. al. 2007)

Regarding the economy and construction, Harty et. al. (2007) suggest one very optimistic future scenario for England in 2050: Increased legislation of building performance and activities of construction at national, international, and global levels have opened up new markets for UK construction firms. Thus, common standards allow expansion of the national construction sector into a global arena. Shifts in technologies have caused radical changes in the production of new materials and the ways of producing them. As a result, greater economies ensure that sustainability is addressed through energy efficient, clean materials, using smart cladding systems, nano technology, and intelligent computers. However, interconnectivities between factors, such as economic, technological, political, and social trends are difficult to take into account for creating future scenarios.

In conclusion, more research and development is needed to better understand the linkages between goals, objectives, test methods, risks, design tools, and methods concerning the construction sector. Further development concepts will have to be about life cycle of the building, use, and the material needed. Future work has to be about performance-based building regulation, and must address spatial planning, changing demographics, adapted innovation in construction and building materials, and risk management in order to respond appropriately to climate change and its effects. However, the physical form of the building stock is very much dependent on the linkage between buildings, and their functions and values. Hence, the future depends on continuing flows of activity, financial investment, and cultural identity. (Meacham et.al. 2005).

Trends and Future Prospects – Construction Sector	**Authors**	**Year**
Construction and its impacts on resources, like land, materials, energy, water and human/social capital	Bourdeau	1999
Future scenarios of construction in 2050, utility of future studies	Harty, Goodier, Chris, Soetano, Austin, Dainty, Price	2007
Future of performance-based building regulation, emerging threats and hazards, changing demographics	Meacham, Bowen, Traw, Moore	2005
Built environment within the context of climate change, adaption to weather extremes through microgeneration, low energy design, future advances to 2050	Roberts	2008
Housing Stock Issues, Trends towards housing forms and occupation, energy efficiency and performance, consumer demands, and technology	Ravetz	2008

Table 7: Construction Sector: literature on future trends

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9. Annex

The following table shows the construction sub-sectors according to NACE 1.1 version

Sector	NACE 1.1	Sub-sector
Construction	F45	Construction
	F45.1	Site preparation
	F45.11	Demolition and wrecking of buildings; earth moving
	F45.12	Test drilling and boring
	F45.2	Building of complete constructions or parts thereof; civil engineering
	F45.21	General construction of buildings and civil engineering works
	F45.22	Erection of roof covering and frames
	F45.23	Construction of motorways, roads, airfields and sport facilities
	F45.24	Construction of water projects
	F45.25	Other construction work involving special trades
	F45.3	Building installation
	F45.31	Installation of electrical wiring and fittings
	F45.32	Insulation work activities
	F45.33	Plumbing
	F45.34	Other building installation
	F45.4	Building completion
	F45.41	Plastering
	F45.42	Joinery installation
	F45.43	Floor and wall covering
	F45.44	Painting and glazing
	F45.45	Other building completion
	F45.5	Renting of construction or demolition equipment with operator
	F45.50	Renting of construction or demolition equipment with operator

The following table shows the construction sub-sectors according to NACE 2.0 version

Sector	NACE 2.0	Sub-sector
Construction	F41	Construction of buildings
	F41.1	Development of building projects
	F41.1.0	Development of building projects
	F41.2	Construction of residential and non-residential buildings
	F41.2.0	Construction of residential and non-residential buildings
	F42	Civil engineering
	F42.1	Construction of roads and railways
	F42.1.1	Construction of roads and motorways
	F42.1.2	Construction of railways and underground railways
	F42.1.3	Construction of bridges and tunnels
	F42.2	Construction of utility projects
	F42.2.1	Construction of utility projects for fluids
	F42.2.2	Construction of utility projects for electricity and telecommunications
	F42.9	Construction of other civil engineering projects
	F42.9.1	Construction of water projects
	F42.9.9	Construction of other civil engineering projects n.e.c.
	F43	Specialised construction activities
	F43.1	Demolition and site preparation
	F43.1.1	Demolition
	F43.1.2	Site preparation
	F43.1.3	Test drilling and boring
	F43.2	Electrical, plumbing and other construction installation activities
	F43.2.1	Electrical installation
	F43.2.2	Plumbing, heat and air-conditioning installation
	F43.2.9	Other construction installation
	F43.3	Building completion and finishing
	F43.3.1	Plastering
	F43.3.2	Joinery installation
	F43.3.3	Floor and wall covering
	F43.3.4	Painting and glazing
	F43.3.9	Other building completion and finishing
	F43.9	Other specialised construction activities
	F43.9.1	Roofing activities
	F43.9.9	Other specialised construction activities n.e.c.

The EU biggest construction companies in 2009

	Company name	Country	NACE 2.0 code
1.	HOCHTIEF AKTIENGESELLSCHAFT	DE	4120
2.	ACS ACTIVIDADES DE CONSTRUCCION Y SERVICIOS SA	ES	4120
3.	FOMENTO DE CONSTRUCCIONES Y CONTRATAS SA	ES	4213
4.	COLAS	FR	4211
5.	SAIPEM S.P.A.	IT	4120
6.	BALFOUR BEATTY PLC	GB	4120
7.	BILFINGER BERGER AG	DE	4120
8.	WASPAR LIMITED	IE	4110
9.	ACCIONA S.A.	ES	4120
10.	SACYR VALLEHERMOSO SA	ES	4110
11.	ABENGOA SA	ES	4399
12.	FERROVIAL AGROMAN SA	ES	4211
13.	CARILLION PLC	GB	4120
14.	NCC AB	SE	4120
15.	OBRASCON HUARTE LAIN S.A.	ES	4120
16.	GS SPA	IT	4120
17.	ABERTIS INFRAESTRUCTURAS S.A.	ES	4211
18.	INFRABEL	BE	4211
19.	BALFOUR BEATTY GROUP LIMITED	GB	4120
20.	DRAGADOS SOCIEDAD ANONIMA.	ES	4211
21.	FCC CONSTRUCCION SA	ES	4120
22.	SKANSKA SVERIGE AB	SE	4120
23.	ACCIONA INFRAESTRUCTURAS SA	ES	4120
24.	BOCOGE S.P.A. - COSTRUZIONI GENERALI	IT	4120
25.	S.G.F. - I.N.C. S.P.A.	IT	4399
26.	TAYLOR WIMPEY PLC	GB	4120
27.	AMEC P L C	GB	4120
28.	SACYR SA	ES	4120
29.	ADMINISTRADOR DE INFRAESTRUCTURAS FERROVIARIAS	ES	4212
30.	KIER GROUP PLC	GB	4120

Source: Amadeus data base

Sectoral Institutions and Initiatives

- European Construction Technology Platform (www.ectp.org/default.asp),
- 7 Working Groups at EC level are concerned with different aspects of the construction sector (http://ec.europa.eu/enterprise/sectors/construction/documents/construction-working-groups/index_en.htm),
- European Construction Industry Federation (www.fiec.org),
- Council of European Producers of Materials for Construction (www.cepmc.org/en/),
- European Union of Developers and House Builders (www.uepc.org/uepc/home.cfm),
- European Insulation Manufacturers Association (www.eurima.org),
- European Builders Confederation (www.eubuilders.org),
- Association of European Building Surveyors and Construction Experts (www.aeebc.org),
- European Construction Technology Platform (www.ectp.org),
- The European Council for Construction Research, Development and Innovation (www.eccredi.org),
- European Network of Building Research Institutes (www.enbri.org),
- The EC Lead Market Initiative – Sustainable Construction (http://ec.europa.eu/enterprise/sectors/construction/lead-market-initiative/index_en.htm),
- European Sectoral Social Dialogue in Construction (http://ec.europa.eu/social/main.jsp?catId=480&langId=en&intPageId=23),
- Posting of Workers in the Construction Industry (www.posting-workers.eu),
- Steel Sector Sustainability Strategy (www.steelconstruction.org),
- Building Responsible Competitiveness in the Construction Sector (www.csreurope.org/pages/en/brc.html),

Major European legal frameworks relevant to the sector

EU legislation affecting environmental issues

- The European Construction Products Directive or CPD (89/106/EC), amended 1993 by Council Directive 93/98 EEC,
- The EU Directive on the energy performance of buildings (2002/91/EC),
- Council Directive 67/548/EEC on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances,
- Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH),
- Directive 2008/1/EC of the European Parliament and of the Council concerning integrated pollution prevention and control (IPCC),
- Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community,
- The Eurocodes - a set of common standards containing the European calculation methods to assess mecanical resistances of structures and comprises 58 European standards (http://ec.europa.eu/enterprise/sectors/construction/eurocodes/index_en.htm).

EU legislation affecting quality of work

- Directive 91/533/EEC on an employer's obligation to inform employees of the conditions applicable to the contract or employment relationship,
- Council Directive 1999/70/EC of 28 June 1999 concerning the framework agreement on fixed-term,
- Council Directive 97/81/EC of 15 December 1997 concerning the Framework Agreement on part-time work,
- Directive 2008/104/EC of the European Parliament and of the Council of 19 November 2008 on temporary agency work,
- Directives aimed at improving health and safety at work: 89/391 (Framework), 89/654 (Workplaces), 89/655 (Work Equipment), 89/656 (Personal Protective Equipment), 90/269 (Manual Handling of Loads) and 90/270 (Display Screen Equipment), Directive 91/383/EEC,
- Council Directive 94/33/EC of 22 June 1994 on the protection of young people at work,
- Directive 2003/88/EC of the European Parliament and of the Council of 4 November 2003 concerning certain aspects of the organisation of working time,
- Directive 96/71/EC of the European Parliament and of the Council of 16 December 1996 concerning the posting of workers in the framework of the provision of services,
- Directive 2008/94/EC of the European Parliament and of the Council of 22 October 2008 on the protection of employees in the event of the insolvency of their employer,
- Council Directive 2001/23/EC of 12 March 2001 on the approximation of the laws of the Member States relating to the safeguarding of employees' rights in the event of transfers of undertakings, businesses or parts of undertakings or businesses,
- The Framework on Information and Consultation (Directive 2002/14/EC) grants basic principles, definitions and arrangements for information of employees at the enterprise level,
- Council Directive 98/59/EC of 20 July 1998 on the approximation of the laws of the Member States relating to collective redundancies.

Databases relevant in the sector

5 major European databases exist on job satisfaction, which meet the restrictive criteria: European in scope, periodically updated and statistically representative. They are not sector specific.

- European Labour Force Survey (ELFS),
- European Working Conditions Survey (EWCS),
- European Survey on Income and Living Conditions (EU-SILC),
- European Structure of Earnings Survey (ESES),
- International Social Survey Programme (ISSP).
- The EU Commission database on national legislation concerning dangerous substances in construction products (www.ec.europa.eu/enterprise/construction/cpd-ds/index.cfm)