BUILDING INNOVATION IN THE EUROPEAN CONSTRUCTION SECTOR

BUILD-NOVA

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D8 – Characteristics of the construction sector – technology and market tendencies

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Abstract:
This document presents the main characteristics of the construction sector related to innovation and its financing as well as an outline of the main technology and market tendencies for the future

Sixth Framework Programme Priority [1.2.1.4] – Networking
Innovation Actors by Sectors

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The BUILD-NOVA Consortium consists of the following institutions:

LABEIN	Principal Contractor & Co-ordinator	Spain
CeDuBo	Principal Contractor	Belgium
CSTB	Principal Contractor	France
VTT	Principal Contractor	Finland
ASM	Principal Contractor	Poland
FCC	Principal Contractor	Spain
MOSTOSTAL	Principal Contractor	Poland
BOEGE	Principal Contractor	Germany

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1 A big picture of the European construction industry

Construction is one of the main activities in all the developed countries. The statistical sources confirm this importance:

- EUROCONSTRUCT (www.euroconstruct.org) : the building activity is about 9.2 % of the GDP of EU 25. The UE 25 construction market (building and civil engineering) is around 1200 billion euros. The civil engineering's share is about one fifth,
- FIEC (European Construction Industry Federation, www.fiec.eu): the share of the EU 21 GDP is 10,2% and the share of the Gross Fixed Capital Formation is 53,1%. The rate of employment is 7,2% of the total employment.

Number one market is Germany (17 % of total EU 25), before UK, Italy, France and Spain. These five countries represent about 74% of total. The ten new comers countries' share is 4, 5 % of the total.

Within this huge market, hundreds of thousands companies do innovate either on a daily basis when they face every day new situations that require new design, process, "rule of thumb" or on a longer term basis to develop construction products or processes that are intended to be spread on the national, European or world market. In some cases, daily innovation grows to become marketed products, processes or services.

Construction is not an isolated sector. Buildings are erected to shelter any kind of activity (from dwellings to manufacturing, storage, offices …). On the way round, the construction process requires input from a great number of other sectors including "hardware" (steel, concrete, wood, synthetic material…) and "software" (computers, IT tools, organisation tools, expertise …) products, processes and services.

Innovations that take place in these other sectors may also be beneficial for the construction sector.

The goal of BUILD-NOVA is "*to achieve a better understanding of the success factors involved in innovation funding in the field of Construction. The ultimate objective will be improving such situation by, on the one hand, helping technology firms (both high-tech and less technology intensive companies) to find suitable funding for their new innovative projects, and on the other, helping investors to have a better understanding of* ***the technology and market possibilities*** *of such new ideas*".

Task 2.1 of Work Package 2 intends to identify the main characteristics of the construction sector related to innovation and its financing as well as to outline the main technology and market tendencies for the future.

The output of this work will be proposed for comments to the members of the BUILD NOVA network.

The D 8 report is then divided in two main chapters:

Chapter A: description of the present situation.

Chapter B: presentation of technology and market technologies

EXECUTIVE SUMMARY

Construction is a project-based activity engaged in the conception, design, building, maintenance, re-configuration and demolition of one-of-a-kind products. This activity is then opposed to mass production manufacturing activity to which construction is sometimes (and often inappropriately) compared.

A project team is created for each project which typically lasts some years. The actors engaged in the project team bring a wide range of competences and skills which are necessary at different stages of the project. They may participate for a particular phase of the project for a period ranging from a few days to a few years. This very general description has of course to be adapted to the importance and stakes of the project: building an individual house is far different from building a hospital or erecting a bridge.

In spite construction is often perceived as a laggard sector for innovation compared with other industries, innovation is indeed quite intense but is perceived in very different ways according to the actor and to the moment when he or she is involved in the project.

This part of the report intends to address this diversity by presenting the roles of the main actors among which three of them (contractors, manufacturers and products distributors) were selected for a detailed presentation in each of the BUILD-NOVA partners' countries.

This presentation acknowledges that 90% or more of contractors are (very) small enterprises. This small size hardly allows resources for R&D activity. Manufacturers are generally bigger companies which often host in-house R&D structures. The distribution of products is ensured either by independent companies or by subsidiaries of manufacturers.

All these actors do innovate as it is demonstrated by the analysis of indicators including R&D expenditures and patents. Another more construction specific indicator comes from the analysis of the performance assessment procedures of products and processes. Several of the BUILD-NOVA partners participate in such assessments and register a great number of demands per year.

These indicators are mainly pertinent for manufacturers who innovate for example in ICT applications, materials development, process productivity, eco-friendly processes and products, smart product components, sensor technology for building maintenance…

The innovation activity of contractors is acknowledged by other indicators such as the innovation awards organised in big construction companies or at a national/regional level in some partners' countries. These innovations are very often motivated by construction site problems solving. These informal innovations concern for instance security and safety on sites, productivity, innovative processes to eliminate waste, management of material flows …

Products distributors mainly innovate on services, e-commerce and exchange of information with suppliers.

This duality consisting of "traditional" innovation on the manufacturer's and distributor's side and more site-specific innovation on the contractor's side is very representative of the construction activity. The great diversity of predominant construction processes among BUILD-NOVA partners' countries makes a description of the whole picture quite complex. The analysis of strengths and weaknesses of the sector as regard to technical, innovation and cultural aspects acknowledges this situation.

Moreover, the situation is different in building and civil engineering domains but BUILD-NOVA mainly addresses the building construction.

Depending on countries, public financing and expert structures are targeted on research and technological development. The situation concerning funding programmes to support construction innovation also appears to be very different from country to country.

In some cases, private supports have been identified, but these situations are rather rare as compared to the demonstrated interest of these actors for more emergent markets.

This great variety of situations reinforces the aim of BUILD-NOVA to clarify the ins and outs of the innovation financing in construction.

1 Introduction

Before thinking of improving the situation of the construction sector and to help firms to find suitable funds for their innovations, we have to describe this present situation. To do so, it is necessary:

1. to describe the innovation framework. This task requires to collect data on :
    a. the actors of the sector,
    b. the indicators of the innovative activity,
    c. the role of public funding programmes and public support structures.
2. to examine the strengths and weaknesses of the construction sector.
3. to identify which actors may encounter difficulties to find suitable funds for their innovative projects.

These points are developed in the three following chapters.

2 The innovation framework

For the actors of the construction sector, the potential for innovation relies, among other things, on their position in the construction organisation system. The potential is for instance not the same for a company belonging to an oligopoly with important financial capacities as for a craftsman who works alone with very limited financial resources.

Similarly a contractor does not face the same issues as a manufacturer: the nature of the innovation process and innovation drivers differ. The manufacturer's job is to develop products and/or services when the job of a contractor is to work on specific projects.

It is then important to **identify these actors** in term of activity, number of companies, annual turnover. When possible, **indicators on their innovative activity** will be useful for the BUILD-NOVA project.

The collection of these data will help drawing a clear image of the domain where we are going to work. By processing these data, we will argue the selection of case studies and of action lines for the rest of the project.

Data were collected from BUILD NOVA partners by means of a template.

2.1 ACTORS TYPOLOGY

In each partner's country, the construction process involves a group of actors who ensure similar functions. Differences may exist according to local situations but the proposed categories (table 1) correspond to the following general planning of any construction project:

specifications – construction - exploitation

Definitions of categories and data may differ from one country to the other according to national statistical specificities. It then often happened to be difficult getting homogeneous data and definitions across countries.

Information concerning contractors and manufacturers never lacked. Conversely, it was more difficult to gather information on designers, product distributors and service providers.

Table 1: Typology of main construction actors

Building owner:	At the origin of a building project with a specific purpose (housing, office, hospital, school, theatre…). He generally directly pays for the building design and construction but in some cases (PFI, BOT…) it is not the case.
Building user(s):	Designates people who use the building. They may also exploit the building but not always (for instance schools, hospitals, …)
Designer	Any skilled professional in charge of architectural/technical design
Contractor	Firm[1] that is specialized in building construction. There is a wide variety of specialties corresponding to all the technical aspects of a building.
Products manufacturer	Firm that produces any piece of construction needed for the building
Products distributor	Commercial/technical intermediary between products manufacturers and contractors
Material supplier	Firm that provides material necessary for the production of building products by products manufacturers
Service provider	Firm that is likely to take (totally or partly) in charge the exploitation/maintenance of the building

We now present data concerning three categories of actors, namely:

- Contractors
- Products manufacturers
- Products distributors

2.1.1 Contractors

As far as possible, we address the following points for each country:

- general presentation of the construction sector (turnover, size of companies, …)
- employment
- share of different markets (new buildings, refurbishment, civil engineering, …)

The presentation may not exactly follow this list because of the availability of data according to countries. Partners' countries are listed in alphabetic order.

[1] The term firm is synonym of company

Belgium

The sector of Construction and civil engineering is in Belgium divided in 3 subsectors: Construction of houses (residential), of non-residential buildings and civil engineering (mainly road and rail Construction). Construction is cheaper in the Walloon part of the country. The most expensive region is Brussels. The average price of a dwelling was in 2003 117.500 euros.

The total 2003 yearly turnover for the building sector was about 25 billion euros. The presentation of regional information concerning construction firms is given in table 2.

Table 2- Number of firms and employees in Flanders, Wallonia and Brussels

	Flanders		**Wallonia**		**Brussels**		**Total**	
	Firms	Employees	Firms	Employees	Firms	Employees	Firms	Employees
Number	44.625	144.982	21.373	70.981	3.668	18.982	69.666	234.945
Turnover (€)	16.125.339.942		6.789.130.400		2.085.529.602		24.999.999.944	

Source: BBRI (2003)

The statistics of the activities in the Belgian construction sector is given in table 3, where the global construction activity as well as the breakdown of the building activity (new and renovation) per region are presented.

Table 3 – presentation of the yearly Belgian construction activity (million €)

	1999	**2000**	**2001**	**2002**	**2003**	**2004**
Global						
buildings	5.644	6.464	5.942	6.120	6.638	6.911
civil engineering	3.036	3.189	3.307	3.027	2.973	3.199
finishing	3.760	4.066	4.351	4.348	4.567	4.700
Total	12.439	13.719	13.601	13.495	14.178	14.810
New buildings						
Residential						
Number of buildings	26.607	24.825	23.805	25.200	28.305	31.482
Number of dwellings	42.921	41.277	42.156	45.080	52.186	59.252
Flats	18.477	18.712	20.689	22.582	27.062	31.509
Other dwellings	24.444	22.565	21.467	22.498	25.124	27.743
Tot.surface (m²)	5.115.296	4.869.233	4.507.750	4.857.081	5.419.646	6.141.516
Average surface per unit (m²)	119,2	118,0	106,9	107,7	103,9	103,7

Table 3 (continued) – presentation of the yearly Belgian construction activity (million €)

New buildings						
Non residential						
Number of buildings	6.396	5.484	4.550	3.890	4.271	4.218
Tot.volume (m³)	47.623.376	49.472.816	34.948.496	29.334.352	37.492.320	40.729.280
Average volume per building (m³)	7.446	9.021	7.681	7.541	8.778	9.656
Renovation						
Residential	25.719	24.355	25.159	28.713	27.966	28.084
Non residential	6.158	5.719	6.117	6.406	6.317	5.998
Per region (in % of Belgium)						
All permits						
Brussels	2,4%	2,3%	2,1%	2,4%	2,7%	2,7%
Flanders	65,5%	67,6%	69,1%	69,7%	68,3%	68,3%
Wallonia	32,0%	30,1%	28,8%	27,9%	29,0%	29,1%
Residential						
Brussels	1,1%	1,3%	1,2%	1,6%	1,4%	1,1%
Flanders	66,0%	67,2%	68,0%	68,1%	69,3%	70,1%
Wallonia	32,9%	31,5%	30,8%	30,3%	29,3%	28,8%
Non residential						
Brussels	0,9%	0,9%	1,0%	1,0%	1,0%	0,9%
Flanders	60,7%	65,2%	67,4%	74,3%	77,6%	77,5%
Wallonia	38,4%	33,9%	31,6%	24,7%	21,4%	21,5%
Rénovation (redidential)						
Brussels	4,0%	3,6%	2,9%	3,2%	4,3%	4,6%
Flanders	64,9%	67,4%	69,2%	68,6%	64,4%	64,3%
Wallonia	31,1%	29,1%	27,9%	28,2%	31,3%	31,1%
Renovation (non residential)						
Brussels	3,1%	2,5%	2,9%	2,9%	2,3%	2,9%
Flanders	71,4%	72,6%	74,4%	77,8%	75,0%	70,7%
Wallonia	25,5%	24,9%	22,7%	19,4%	22,7%	26,4%

Finland

In 2004 the total number of construction companies registered by the Finnish statistics was 31 932 with a join turnover of 18 314 billion euros (for building and construction) and 128 386 employees. From these total 93% of the companies have less than 10 employees and 83% have an annual turnover under 0.4 million euros (tables 4 and 5).

Table 4 - Number of firms and turnover by employee class for years 2001 to 2004

			Companies by employee class				
			Companies	Personnel	Turnover	Salaries	Turnover/employee
	year	Employees class	*number*	*employees*	*1000 euros*		
Construction	2004	< 4	27 138	30 276	3 411 413	501 328	112.7
		5... 9	2 703	17 313	1 861 235	438 582	107.5
		10... 19	1 296	17 152	1 984 929	455 483	115.7
		20... 49	594	17 071	2 368 467	481 991	138.7
		50... 99	117	8 034	1 150 327	239 754	143.2
		100...249	60	9 183	2 129 240	306 642	231.9
		250...499	11	4 212	.	.	.
		500...999	2	1 418	.	.	.
		> 1000	11	23 728	4 282 944	784 530	180.5
		Total	**31 932**	**128 386**	**18 313 912**	**3 381 935**	**142.6**

Source: **Statistics Finland 2/24/2006** http://tilastokeskus.fi/til/syr/tau.html

Table 5 - Number of firms and employees by turnover class for years 2001 to 2004

			Companies by turnover class				
			Companies	Personnel	Turnover	Salaries	Turnover/salary
	Year	Turnover class (1000 euros)	*number*	*employees*	*1000 euros*		
Construction	2004	< 1	166	242	-	5 450	-
		1 - 39	7 303	2 245	181 410	15 906	80.8
		40 - 99	9 770	7 481	633 471	73 633	84.7
		100 - 399	9 311	20 395	1 857 868	404 703	91.1
		400 - 1 999	4 409	34 201	3 664 894	878 073	107.2
		2 000 - 9 999	818	21 741	3 119 557	624 420	143.5
		10 000 - 39 999	109	10 147	1 848 563	323 088	182.2
		40 000 - 199 999	38	13 476	3 052 449	444 174	226.5
		> 200 000 -	8	18 459	3 955 700	612 488	214.3
		Total	31 932	128 386	18 313 912	3 381 935	142.6

***Source*: Statistics Finland 2/24/2006**

This activity is distributed on market segments as shown on figure 1.

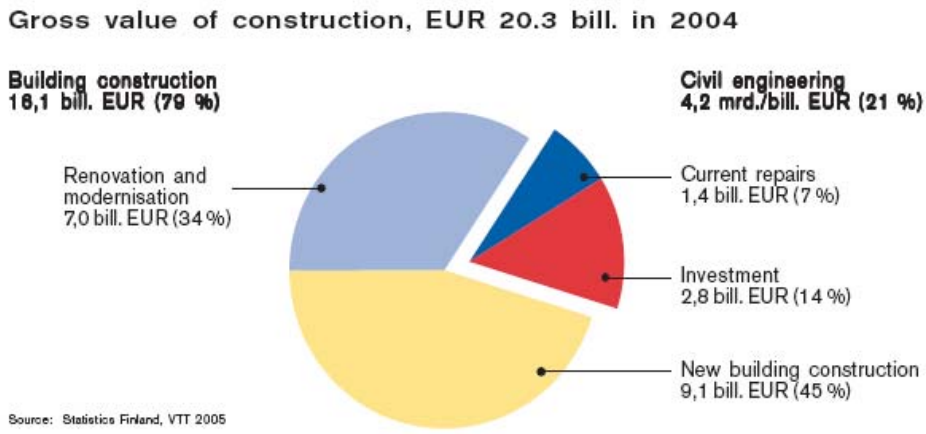

Figure 1: activity of the Finnish contraction sector

Table 6 shows the number and size of these companies in the main business lines. Around 35% of the total contractors do general buildings construction and these concentrate 46% of the join turnover and 33% of the total employees. However companies are cross-functional and work in several business lines. 47% of the Confederation of Finnish Construction industries (RT) contractor companies work in 5-7 different activities (figure 2).

Table 6 - Number and size of construction contractors by business line (2004).

	Contractors by business line				
	Number of companies	***Personnel***	***Turnover***	***Salaries***	***Turnover/ Employee***
Business line	*number*	*employees*	*1000 euros*		
Construction foundations	**5262**	**12298**	**1664871**	**254907**	**135.4**
Foundations cleaning and demolition	5261	12297	.	.	.
galleries and tunnels drilling	1	-	.	.	.
Building construction. land and water	**15467**	**72205**	**12108165**	**1996769**	**167.7**
Building construction. land and water	11556	49021	9187796	1346082	187.4
general buildings construction	11328	43307	8459734	1155841	195.3
Bridges. tunnels and electric lines	228	5714	728062	190241	127.4
roofing and covers installation	366	1610	167407	39697	104
Roads. airport and sport tracks structures	942	11765	1797334	367994	152.8
water structures construction	193	594	103102	17046	173.5
other special construction	2410	9215	852526	225950	92.5
Building Installation	**6694**	**30702**	**3371368**	**831535**	**109.8**
electric wires and equipment	3179	12575	1273785	336051	101.3
insulation works	278	1589	139854	40646	88
Heating. water and air	3117	16319	1934043	450154	118.5
other construction installations	120	220	23686	4684	107.9
Construction finishing	**4180**	**11697**	**1008244**	**260120**	**86.2**
plaster works	47	219	22963	5361	104.9
installation of carpentry works	1458	2258	207966	40319	92.1
floors and walls covering	777	2353	241488	57058	102.7
paintings and glass finishing	1730	6262	479613	141710	76.6
Other construction finishing	168	607	56214	15672	92.7
Renting of construction machinery	**329**	**1485**	**161264**	**38604**	**108.6**
Total	**31932**	**128386**	**18313912**	**3381935**	**142.6**
Source **: Statistics Finland 2/24/2006**					

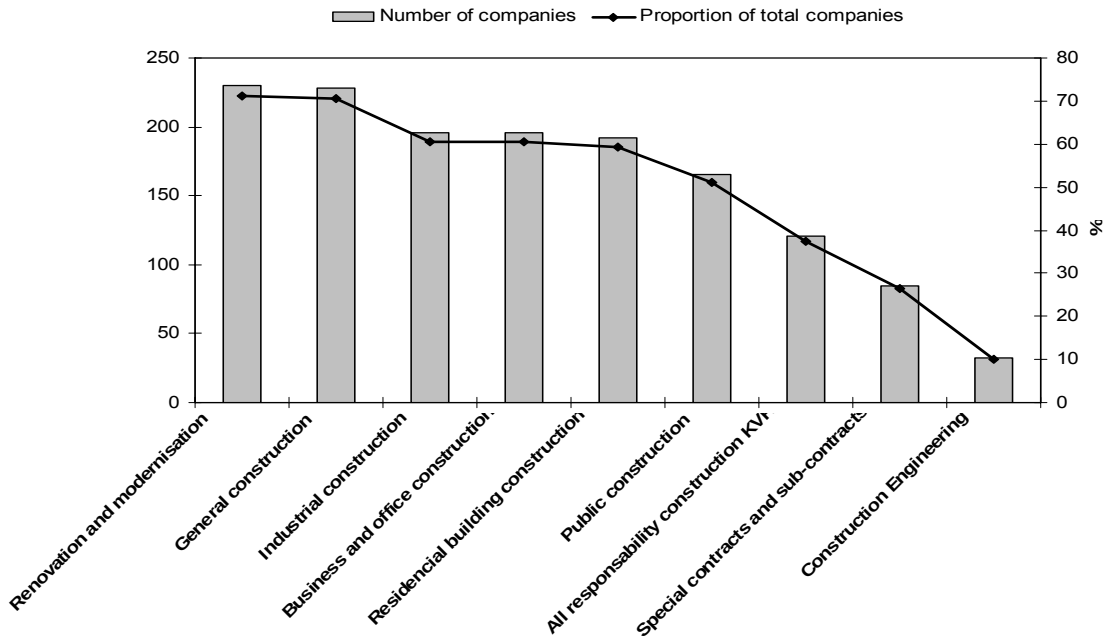

Figure 2: Companies cross-functions: number of companies in each main activities and proportion from the total of companies (Source: Confederation of Finnish Construction industries)

Table 7 indicates the main domains of activity of Finnish construction companies.

Table 7 – domains of projects development for contractors in Finland

		Main areas of interest developed/planned on projects in Finland
Contractors	93% of the companies have less than 10 employees The biggest companies operate in multi-activities	- Integration of maintenance services in a whole life thinking – contractors extending their activities to include services - Integrate delivery through partnering - Innovative processes to eliminate waste within the whole construction process - Construction automation systems to replace human labour in all hazardous conditions - Security and safety: Security at work and in systems**.** Data security - Development of tools for the analysis of indoor environment Conditions - space models for the visualisation and virtualisation of the indoor environment. - Energy efficiency of alternative building structures and alternative solutions for technical building service systems. - Management of material flows, project management and electronic information transfer of the subcontractor network - Wireless, open and modular system in real estate environment. - Architecture for the wireless data transfer in buildings. - Tools and techniques for capturing and sharing good and bad construction practices across supply chains and preferred project partners - Development and use of model based applications for total-lifecycle design and maintenance in inter-enterprise setting

Source: Statistics Finland

France

The total (building and public works) annual turnover was a bit more than 135 billion euros in 2005. The total number of employees in 2004 on the building sector was 1 330 600 (8.6 % of total employment). 252 000 persons are self employed.

Table 8 presents the employment, size and turnover of different classes of contractors in 2005. Figure 3 indicates the shares of different market segments.

Table 8 – French building activity: number of firms and turnover by employee class (2005)

Number of employees	< 10	11 to 20	21 to 50	51 to 200	> 200	Majors (3 firms)	Total per line
Number of firms	268 000	11 000	6 500	1 315	182	3	287 000
Turnover (Billion €)	50,6	13,4	18,5	11,2	5,1	6,7	105,5
% annual turnover	48	12.7	17.5	10.6	4.8	6.4	100

Source: Ministry of construction (www.logement.gouv.fr)

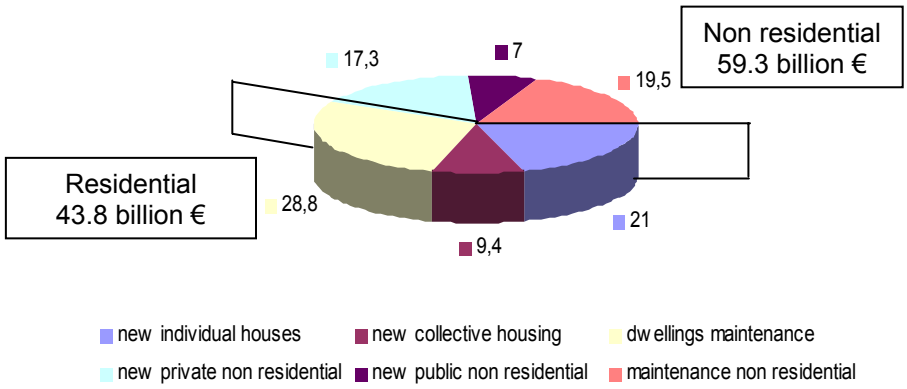

Figure 3: shares of the building sector between residential and non residential market segments (add 2.4 billion € of small civil engineering to reach 105.5) (www.logement.gouv.fr)

The biannual “Palmarès de l’Innovation” (Innovation award) clearly demonstrates that safety on site is a main driver for daily innovation, as well as productivity improvement. Environmental concern is also a significant driver.

Germany

Over a period of 8 years (1996-2004), we see divergent developments: In construction the gross value (measured as volume of contracts in billion of Euros in real prizes of 2000) has declined for about 20 percent. However, German construction still has a percentage of 11.5 percent of GDP.

The construction activity is divided in two sub activities:

- Bauhauptgewerbe: which corresponds for buildings to the structure erection, the envelope works,
- Ausbaugewerbe (or Baunebengewerbe): which correspond for buildings to partition walls installation, plumber, electricity …

Figures 4 and 5 show the distribution of the 2001 total turnover (261.56 billion € - this value may look inconsistent with other annual values. The difference is located in different statistical sources: Table 9 shows only figures which appear in construction statistics whereas figures 4 and 5 include construction activities which are statistically based in manufacturing, in planning and dues and taxes and in "further construction services".)

The number of people being employed in construction has decreased by nearly 30 percent. Simultaneously, the number of firms increased for about 50 percent.

Surprisingly, when looking at the nature of employment, we see that in opposite to the general reduction of employment in German construction, a steady increase of self-employed occurred in construction (table 10). In 2002, already 17, 4 % of all people being involved in construction were working on their own as entrepreneurs. These numbers indicate that firms' sizes shrunk further parallel to the trend of rising self-employment in construction industry.

Table 9 – main figures about German construction sector

	1996	1998	2000	2002	2003	2004
Construction Total						
Construction gross value (billion €)	209,9	202	198,7	174,7	167,8	161,6
Employment (x 1.000)	2.666	2.542	2.383	2.095	1.942	1.696
Enterprises (x 1000)	208,3	297,1	302,7	300,2	297,5	315,0
Bauhauptgewerbe (structure, envelope)						
Construction gross value (billion €)	102,7	97,7	95,1	81,1	77,6	74,4
Employment (x 1.000)	1.521	1.177	1.070	896	833	786
Enterprises (x 1000)	75,4	81,3	81,1	78,5	76,6	76,7
Ausbaugewerbe (equipment, plumber, electricity,)						
Construction gross value (billion €)	107,2	104,3	103,6	93,6	90,2	82,7
Employment (x 1.000)	1.521	1.565	1.313	1.199	1.109	1.110
Enterprises (x 1000)	204,9	215,8	221,6	221,7	220,9	238,3

Source: Bundesamt für Bauwesen und Raumordnung: Bericht zur Lage und Perspektive der Bauwirtschaft 2005, Berlin 2006

Table 10– Employment in German construction in 1996, 2000, and 2002

	1996	2000	2002
Total Employment (x 1.000)	3126	2761	2427
Employees (x 1.000)	2757	2351	2008
Self-employed People (x 1.000)	369	410	419

Source: Deutsches Institut für Wirtschaftsforschung: Laufende Bauvolumensrechnung für Deutschland 2003, Berlin 2004)

The share of employment is with about 7.5 percent in construction comparatively lower than in other countries. However, while the employment share in German manufacturing and industry has been declining, the share proofed to be nearly constant over time in German construction.

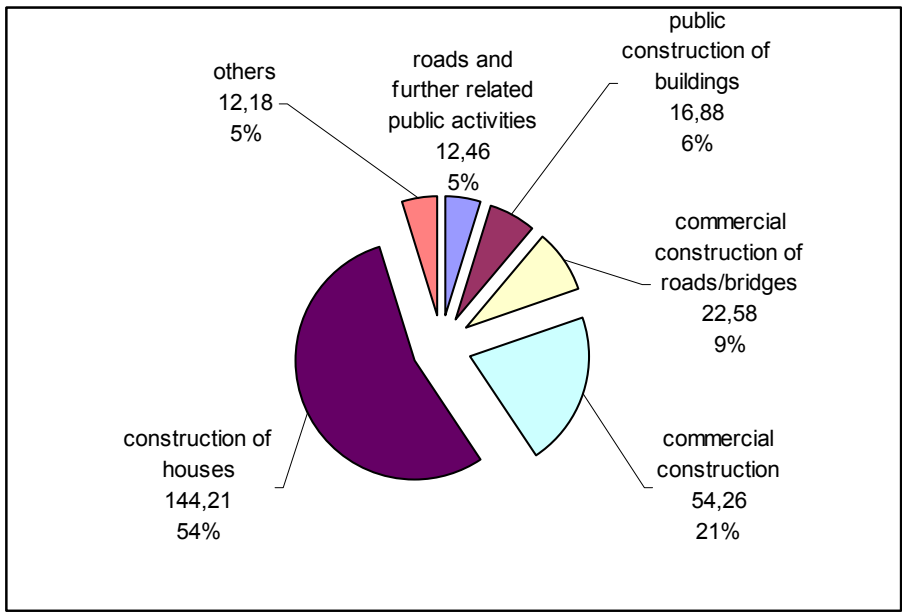

Figure 4: areas of contraction and related activities
Source: Deutsches Institut für Wirtschaftsforschung: Struktur des Bauvolumens in der Bundesrepublik Deutschland 1991 – 2003, Berlin 2004

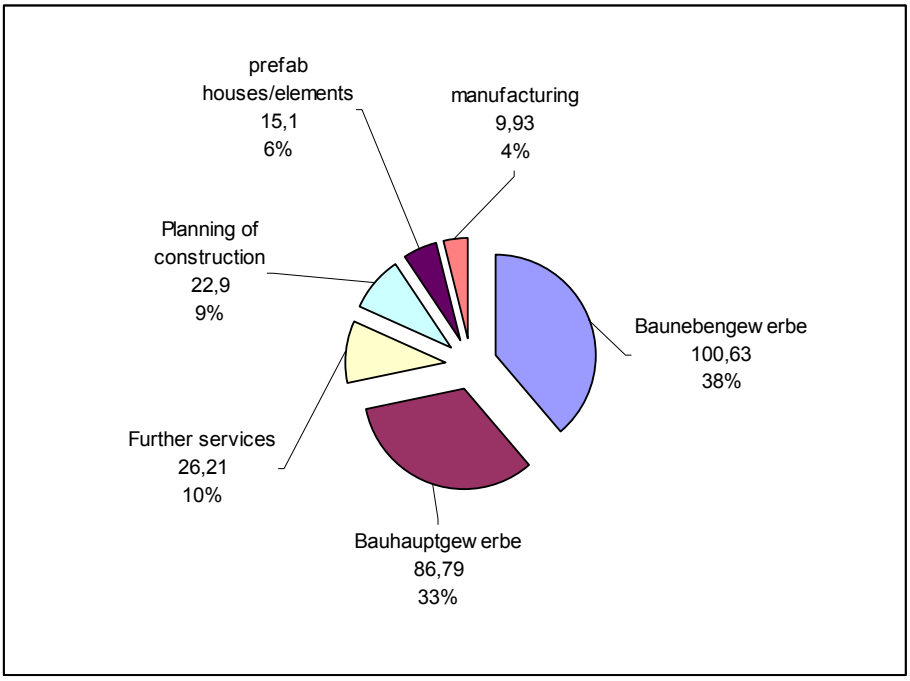

Figure 5: distribution of actors
Source: Deutsches Institut für Wirtschaftsforschung: Struktur des Bauvolumens in der Bundesrepublik Deutschland 1991 – 2003, Berlin 2004

Ireland

According to the 2004 report of the Irish Construction Federation, 21% of the GNP comes from the construction activity. The construction sector is the second largest sector after industry with a cumulative growth of 100% between 1994and 2000 .This gives an annual growth of 11% per annum

Employment in private firms (with five or more persons engaged) in the construction industry increased by 2.6% in July 2006 by comparison with July 2005. The monthly employment index increased from 110.6 in July 2005 to 113.5 in July 2006 (table 11).

Table 11: Index of Employment in Construction July 2006

	Employment in Private Firms (Base year 2000=100) Monthly Index
July 2005	110.6
July 2006	113.5
% annual change	+2.6%

Source: Central Statistics Office, 2006

The annual increase in employment was 2.8% for June 2006. This inquiry covers firms with five or more persons employed.

Poland

Table 12: Production in the construction sector (2005)

New investment works		Renovation works		Total
	% of total		% of total	
29 944,0	70,0	12 845,1	30,0	42 789,2

Structure of construction production – 2005/2006

New investment works 2006 (January – September) 71.2%

Renovation works 2006 (January – September) 28.8 %

New investment works 2005 (January – September) 72.2%

Renovation works 2005 (January – September) 27.8 %

Table 13: Construction sector production by type

Type of Buildings	2005r. I quarter.	2005r. I - II quarter	2005r. I-III quarter	2005r. I-IV quarter
Buildings in total	57,1	52,3	49,1	46,4
RESIDENTIAL BUILDINGS	17,2	15,8	15,4	13,9
including				
Individual houses	2,2	1,7	1,6	1,7
Multi flats buildings	15	14,1	13,8	12,2
NON RESIDENTIAL BUILDNIGS	39,9	36,5	33,7	32,5
including:				
Turist buildings and hotels	1,1	1,0	1,0	0,9
Offices	5,0	4,7	4,3	4,0
Services	7,8	7,4	6,2	6,0
Transport	0,9	0,8	0,7	0,7
Warehouses	15,0	13,5	13,1	12,0
Public utility buildings [education, culture, hospitals, etc.]	8,0	7,1	6,6	6,8
Other non residential	2,1	2,0	1,8	2,1
Water and land engineering buildings	42,9	47,7	50,9	53,6

Source: ASM Quarterly Report "Monitoring of Polish construction sector", April 2006.

Table 14 presents the number and size of construction firms involved in building or civil engineering activity.

Companies with less than 10 employees represent 96% in Poland.

Table 14 - Number and size of contractors by business line (2004)

Type of contractors	**Number of companies by size**				**TOTAL**
Employee class	**0-9**	**10-49**	**50-249**	**250-more**	
Preparation of construction site	**5108**	**191**	**10**	**2**	**5311**
Buildings construction	**98240**	**6606**	**948**	**78**	**105872**
Bridges	**315**	**50**	**24**	**3**	**329**
Specialized type of works – other types [power plants, water objects etc.]	**951**	**231**	**63**	**3**	**1248**
Roofs construction	**13390**	**197**	**270**	**25**	**13882**
Road	**4366**	**749**	**272**	**25**	**5412**
Sea construction	**1508**	**249**	**69**	**3**	**1829**
Specialised construction works	**14636**	**362**	**61**	**9**	**15068**
Networks installations for construction	**83926**	**2492**	**193**	**24**	**86635**
Finishing works	**75588**	**692**	**29**	**1**	**76310**
Renting of construction equipment and machinery	**3371**	**94**	**20**	**0**	**3485**
Other	**26090**	**5501**	**0**	**0**	**0**
TOTAL	**327489**	**12414**	**1832**	**186**	**341 921**

Spain

The Spanish Association of Construction Companies (SEOPAN) gives the following information on the number of construction companies in Spain in its 2004 report on the construction sector (table 15). The great majority (90.5%) of contractors have less than 10 employees. Self-employed people represent a high share of the sector.

Table 15 – number of employees in the construction companies in Spain

Type of Company	**Self-employed**	**Micro**	**Small**	**Medium**	**Tall**	**Total**
Number of employees	**Without employees**	**< 10**	**10 – 19**	**20 – 199**	**> 200**	
Preparation of work sites	1.333	3.865	500	452	5	6.155
General construction	89.037	96.737	14.021	10.963	407	211.165
Installations of buildings and civil works	36.639	38.740	4.223	2.569	70	82.241
Finishing of buildings and civil works	50.956	36.787	2.542	1.308	10	91.603
Renting of construction machinery	79	143	32	68	1	323
Total Construction	**178.044**	**176.272**	**21.318**	**15.360**	**493**	**391.487**
Total Economy	**1.500.396**	**1.265.349**	**98.245**	**73.387**	**5.206**	**2.942.583**

In the same report of SEOPAN, the production of the construction sector was estimated to be 150 billion euros in 2004 (75.8% for building, 24.2 % for civil engineering). This production does not include Value Added Tax (VAT), which was 8.5 billion euros for the same year. The brut added value was 48% of the total production (VAT included) and was 76 billion euros.

The brut added value represents 9, 5% of the total Spanish brut added value and is growing faster then the Brut Interior Product of Spain (3,7% compared to 2,7%).

About 24% of the production was realised in civil works, 33% in residential buildings, 18% in non-residential buildings and 25% in rehabilitation.

This report also mentions the employment in the construction industry in 2004, which was 2.058.000 persons (12% of the total employment), with an increase of 3.7% when compared with 2003. Of these employees 55,8% had a temporary contract.

The level of education of the employees is significantly lower in the construction sector than in the economy in general. About 30% of the employees in construction has no or only primary education (19% in economy in general), about 56 % has secondary education (50% in economy in general) and only 14% has higher education (31% in economy in general).

An important fact is that the percentage of foreign employees (9 %) is almost the double of that in economy in general (4,7%). Striking is the percentage of female employees in construction (almost 6%) compared to that of economy in general (almost 40%).

Synthesis on the chapter “contractors”

It appears from these tables that

- The great majority of contractors are very small: firms employing less than 10 employees represent 90.5% in Spain – 93% in Finland and in France – 96% in Poland.
- Self-employed people represent a high share of the sector.

Case studies also indicate that:

- informal innovation is overwhelming / Importance of the know-how of the employees working on the building site.
- main areas of innovation concern security and safety, productivity, integration of maintenance services in a whole life thinking, innovative processes to eliminate waste, management of material flows, architecture for the wireless data transfer in buildings…

2.1.2 Manufacturers

Belgium

Table 16: Number and size of construction products industries by business line

Activity	Number of firms		Number of employees		
	NL	FR	< 20	20 – 200	> 200
Concrete	**240**	**133**	291	78	4
Concrete products	**346**	**124**	348	113	9
Cement and Lime	**26**	**36**	28	23	11
Ceramics	**173**	**165**	316	19	3
Tiles	**72**	**13**	56	25	4
Quarries (stones and sand)	**131**	**185**	258	52	6
Glass and glass products	**155**	**111**	207	47	12
Wood (plates)	**110**	**27**	93	39	5
Taps and clinchers	**21**	**30**	34	17	0
Heating	**61**	**37**	71	20	7
Paints and varnish	**56**	**21**	62	13	2
TOTAL	**1322**	**882**	**1764**	**446**	**63**

Source: Arvato Services (2005), Industry

Finland

In 2004 there were a total of 3185 companies manufacturing construction products of wood, glass, ceramic, cement, concrete, stone, and metal. Number and size of the main construction products companies within these main product categories are detailed in table 17. Wood and metal products are the strongest construction industries in Finland with 81% of the total number of companies and 94% of the total turnover (figure 6).

Table 17: Number and size of construction products industries by business line (2004)

Construction Products manufactures	*Number of firms*	*Employees*	*Turnover*	*salaries*	*Turnover/ employee*
			1000 euros		
Carpentry for construction	**938**	**10250**	**1590325**	**259107**	**155.2**
prefabricated wooden buildings	236	3437	616352	89044	179.3
Other wood products for construction	702	6813	973973	170063	143
Glass and glass products	**46**	**1038**	**215374**	**38045**	**207.4**
flat glass	9	156	28642	5970	183.3
fibreglass and glass wool	16	861	184434	31658	214.3
Other glass	21	21	2298	417	111

Table 17(continued): Number and size of construction products industries by business line (2004)

Construction Products manufactures	*Number of firms*	*Employees*	*Turnover*	*salaries*	*Turnover/ employee*
			1000 euros		
Ceramic products	**18**	**474**	**34285**	**3420**	**72.3**
sanitarian ceramics	2	360	.	.	.
ceramic products for insulation	2	3	.	.	.
Other technical ceramic	4	25	2468	704	99.5
other non-technical ceramic	1	1	.	.	.
fireproof ceramics	9	85	31817	2716	373.9
Ceramic tiles	**3**	**158**	**22455**	**4897**	**142**
bricks and other construction ceramics	**9**	**279**	**40524**	**7970**	**145.2**
Cement, lime and gypsum	**3**	**710**	**241159**	**26792**	**339.7**
Concrete, cement and gypsum	**272**	**6042**	**1157155**	**177993**	**191.5**
Concrete for construction	202	4415	632026	124238	143.1
gypsum for construction	4	186	.	.	.
Ready concrete products	51	860	293033	26762	340.8
Masonry products	4	430	149273	15629	347.5
Cement-fibre	2	134	.	.	.
Other concrete and cement products	9	18	2422	473	137.6
Stone products	**253**	**1394**	**140190**	**35566**	**100.6**
Metal and processed metal products	**292**	**33337**	**15216756**	**1207934**	**456.5**
Processed metal	**146**	**16668**	**7608378**	**603967**	**456.5**
Iron products	29	9944	4656656	374714	468.3
Pipes	40	740	260554	24787	352.2
Other iron products	3	75	23920	2544	319.4
Cold mouldings	1	1	.	.	.
Steel wires	2	74	.	.	.
Other similar iron end-products	15	3108	2323894	116675	747.8
Cast metals	59	2802	343354	85247	122.5
Metal for machinery	**1351**	**11003**	**1579504**	**300381**	**143.5**
Construction metals	1351	11003	1579504	300381	143.5
Metals for carpentry products	184	1408	180992	37377	128.6
Total	3185	156685	20237727	2062105	129.2
Source **: Statistics Finland 2/24/2006**					

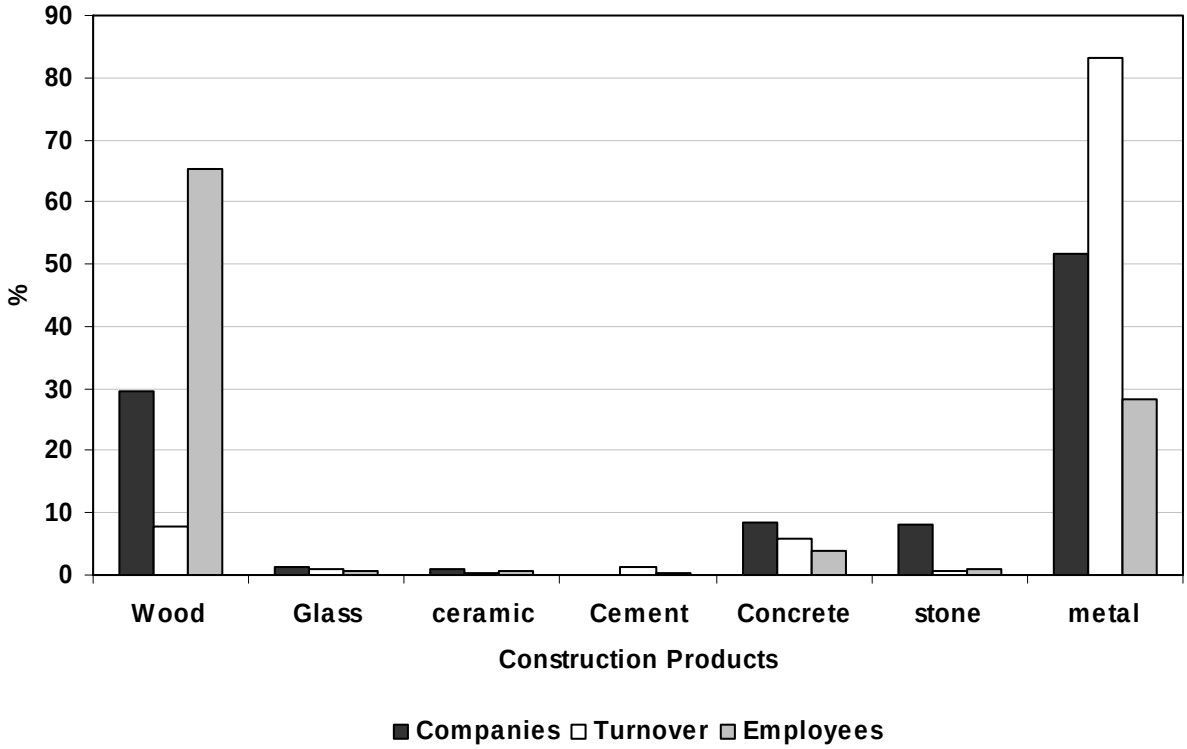

Figure 6: Proportion of the total number of companies, employees and turnover within the main construction products industries (*Source*: Confederation of Finnish Construction industries)

Table 18 lists projects development areas for Finish manufacturers.

Table 18 – domains of projects development for manufacturers in Finland

Category		Main areas of interest developed/planned on projects in Finland
Products manufacturer	Wood and metal products are the strongest constructions industries in Finland	-Simulation of production processes - Application of information and communication technology to the recording of in-use performance of systems, components and whole structures - Materials durability which requires less maintenance - Eco-friendly processes and products - Refining of methods to enable to test the performance of materials and components to be predicted under different environmental scenarios -Application on nano-technology in construction materials in order to develop products with new combination of strength, durability and toughness - Development of product catalogues and product libraries - Smart product components - Sensor technology for building maintenance - Tools for building automation

Source: Statistics Finland

France

Table 19 shows different categories of manufacturers producing goods for construction. Depending on technical domains, SMEs or main companies may play a major role.

Table 19: Number and size of construction products industries by business line

Number of employee per firm	21 to 50	51 to 249	> 250	Majors	Number of firms	Number of employees	Comments
Manufactured products							
Sanitary equipment	3		6		9	3 827	
Floor tiles					21	3 040	And about 20 firms with less than 20 employees. Italian groups dominate.
Bricks	11		2		13	1 637	
Roof tiles					7	3 213	Affiliates of large groups
Cement, sand, gravels, concrete (ready to use + prefab)					609	42 822	71% of firms employ less than 20 people (17% of the workforce)
Rendering and mortars					12	2 506	Many firms with less than 20 employees
Gypsum boards and other products					8	3 775	
Glass sheets	6			2	8	2 790	
Transformation of glass sheets					92	9 519	
Stones parts (blocks, plates, …)					137	6 324	Craftsmen are dominant
Mineral insulating material					50	5 899	2 firms with less than 20 employees
Wood-based panels					70	8 182	4 affiliates of large groups represent 20% of the employees
Roof timbers & wood frames					240	16 835	170 firms with less than 20 employees
Parquet floor					53	4 240	60% of SMEs with less than 50 people
Textile carpets					23	2 573	
Metallic structures, frames, partitions, panels, …					440	26 370	2/3 of SMEs with less than 50 employees – 2/3 of the turnover made by firms with more than 50 people
Metallic doors and window frames					165	10 552	2/3 of SMEs with less than 50 people
Construction plastic products (floor cover, sanitary, …)					260	24 297	3/4 SMEs with less than 100 people
Painting, plastering and adhesives					140	17 103	2/3 of SMEs with less than 100 people
Electrical equipments					222	52 036	Firms with more than 500 people generate 70% of the turnover
Radiators and boilers					25	7 069	
Elevators and escalators					67	16 971	

Source: Services des études et statistiques industrielles (SESSI)/Ministry of economy, finance and industry, www.industrie.gouv.fr/sessi

Table 20 indicates specific domains where innovation takes place and some drivers for innovation.

Table 20: Main features of innovation by manufacturers

Manufactured products	Number of firms	Number of employees	Characteristics of the innovative activity
Sanitary equipment	9	3 827	Innovation mainly concerns aesthetics
Floor tiles	21	3 040	
Bricks	13	1 637	Innovation concerns the process (aim to reduce energy consumption and pollution)
Roof tiles	7	3 213	Innovation concerns the process (new technologies to dry and manufacture tiles)
Cement, sand, gravels, concrete (ready to use + prefab)	609	42 822	Demanding clients drive the innovation process. Innovative products such as high performance concrete. Environmental elements also spur innovation.
Rendering and mortars	12	2 506	Innovative products (improvement of the technical characteristics of the product – products more resistant and easy to use)
Gypsum boards and other products	8	3 775	Environmental innovations and innovations concerning the quality of the product
Glass sheets	8	2 790	Development of “smart” glasses and innovation concerning the process (to reduce the use of the raw material and the pollution)
Transformation of glass sheets	92	9 519	Innovation is stimulated by the evolution of the regulation
Stones parts (blocks, plates, …)	137	6 324	
Mineral insulating material	50	5 899	
Wood-based panels	70	8 182	Environmental innovation concerning the process
Roof timbers & wood frames	240	16 835	
Parquet floor	53	4 240	Technical innovation to ease the maintenance and the installation of the products
Textile carpets	23	2 573	Competition within the sector stimulates innovation
Metallic structures, frames, partitions, panels, …	440	26 370	
Metallic doors and window frames	165	10 552	
Construction plastic products (floor cover, sanitary, …)	260	24 297	Introduction of composites makes innovation possible (new design)
Painting, plastering and adhesives	140	17 103	R&D is important to develop new products that respect the environment
Electrical equipments	222	52 036	
Radiators and boilers	25	7 069	Regulation and environmental constraints spur innovation
Elevators and escalators	67	16 971	R&D – very innovative to improve safety and comfort

Source: Services des études et statistiques industrielles (SESSI)/Ministry of economy, finance and industry, www.industrie.gouv.fr/sessi

Germany

Firms that produce any piece of construction needed for buildings make 9,93 billion Euros (2002) and have 3.8 % of the volume of all contracts in construction. Manufacturers producing prefabricated houses are a subcategory of manufacturers. They have a share of 5.8 % and make 15,10 billion Euros.

Spain

The National Institute of Statistics (Instituto Nacional de Estadistica, www.ine.es) publishes on a yearly basis the Central Directory of Companies (DIRCE in its Spanish abbreviation). Table 21 shows the numbers for some of the manufacturing companies in Spain.

Table 21: Number and size of construction products industries by business line (2005)

Number of employees/firm	Without employees	1 to 19	20 to 199	200 to 499	> 500	Number of firms
Wall and floor tiles	49	163	216	27	5	460
Bricks, roof tiles and other baked products for construction	98	338	204	2	0	642
Extraction of rock	339	808	137	0	0	1.284
Extraction of sand and clay	319	800	171	1		1.291
Cement, lime and plaster	47	119	48	6	5	225
Elements of concrete, plaster and cement	485	2009	720	26	5	3.245
Stone industry	899	3.419	401	6	1	4.726
Glass and glass products	353	923	210	13	7	1.506
Wood structures and pieces for carpentry and for construction	4.197	6.891	374	10	3	11.475
Metallic elements for construction	5.926	15.753	1.343	24	3	23.049
Painting, varnishes, inks	72	399	153	12	4	640
Artificial and synthetic fibres	3	35	18	6	1	63
Electrical equipments and material	626	1.887	565	40	27	3.145

Synthesis on the chapter on manufacturers

It appears from these tables that:

- the average size is larger than for contractors.
- innovation can be radical and rely on ICT and new materials (e.g. “smart” glasses, high performance concrete, composite materials…)
- firms have more or less developed in-house R&D structures.
- there are great differences between countries concerning the predominant construction techniques (e.g.: wood and metal in Finland, concrete and masonry in France …).
- areas of innovation are widespread: Application of information and communication technology, materials durability which requires less maintenance, process productivity, eco-friendly processes and products, smart product components, sensor technology for building maintenance…

2.1.3 Products distributors

Belgium

The presentation of regional information concerning distributors is given in table 22.

Table 22: Number of products distributors by region (2005)

	NL	FR	Total
Distribution of construction materials	**1055**	**455**	**1510**
generalist	770	332	1102
specialist	285	123	408
Do-it-yourself	**454**	**259**	**713**

Source: Arvator services

Finland

Table 23 indicates number and size of wholesales, agents and retailers for construction products. Most of the big manufactures included in table 24 are as well product distributors.

Table 23 - Wholesale and retailers in the construction sector in 2004

	Companies	Employees	Turnover	salaries	Turnover/employee
				1000 euros	
Wholesale and retail	**7964**	**43237**	**16952679**	**1210200**	**392.1**
Agents and wholesales	**5018**	**24908**	**12110705**	**780170**	**486.2**
agents offices	**1489**	**1537**	**270136**	**34638**	**175.8**
sawn wood and construction materials agents	602	542	170907	14062	315.5
Furniture and house commodities	887	995	99229	20576	99.7
Wholesales	**3529**	**23371**	**11840569**	**745532**	**506.6**
wallpaper	5	17	3666	413	211.9
wood, construction materials and bathroom cabinets and sanitarians	1240	6495	4057307	194827	624.7
sawn wood products	496	1858	1157947	51960	623.3
metal and stone products	363	2930	1229953	83318	419.8
bathroom cabinets and sanitaries	14	68	33639	2960	495.4
Construction equipment and utensils	243	1409	1170295	48666	830.6
iron utilities, Heating-water-air, utensils	584	5297	2093881	181694	395.3
tools and equipments	323	2549	711442	83450	279.1
Heating-water-air, utensils	232	2634	1316204	94444	499.7
tools and utensils	29	114	66235	3800	583.6
retail	**2946**	**18329**	**4841974**	**430030**	**279.4**
iron products and paints	1473	9164	2420987	215015	264.2
Iron and construction utensils	468	5661	1813709	132289	320.4
painting	91	753	146705	17409	194.9
Kitchen and bathroom furnishings	174	486	77626	10992	159.8
locksmith and keys	185	992	136327	26233	137.5
other iron and construction retails	555	1273	246620	28092	193.7

Source **: Statistics Finland 2/24/2006**

Table 24 – domains of projects development for products distributors and services providers in Finland

Category		Main areas of interest developed/planned on projects in Finland
Products distributor	3529 wholesales with join turnover of 12M€ 2946 retails with join turnover of 5M€	Increase of e-commerce and sharing information with suppliers and clients
Services providers	Maintenance and repair services and Management of projects. Big construction companies are expanding to these activities	-Basis for life cycle services: including contents of services, contract models, validation of service performances, risk management methods, new logics for making business, energy performance contracting, total life cycle delivery of technical system entities - Acquisition processes to improve the availability and accessibility of such services from the point of view of building owners. - Develop of an open method for managing real estate information in co-operation with clients and service suppliers. - Methods for learning and the smart management of indoor environment control for system integration of technical building services. - Simulator based solutions for training purposes. Ease the start-up training of new products with the use of modern tools and speed up product development and testing.

Source: Statistics Finland

France

The distribution activity is rather concentrated as shown in table 25. The order of magnitude of the annual turnover is 36 billion euros in 2001.

Table 25: Number of products distributors

Network of distributors	***% network***	***% total***	***Comments***
Non specialised	*46,5*	*33,2*	Point P, the leader, holds 12% of the market share. Most innovation concern the service (for example development of credit facilities, site logistics)
Sanitary & heating equipments	*18,2*	*13,0*	
Plastic products	*2,5*	*1,8*	
Electrical equipment	*24,8*	*17,7*	
Decoration products	*8,0*	*5,7*	
S/total professional networks	***100,0***	***71,4***	
Do-it yourself	*68,9*	*19,1*	Kingfisher France, the leader, holds 8% of the market share.
Specialised supermarkets	*11,5*	*3,2*	
Non specialised supermarkets	*13,9*	*3,9*	
Traditional stores	*5,7*	*1,6*	
S/total general public	***100,0***	***27,7***	
Miscellaneous		***0.8***	
Total		***100,0***	

Source: POINT P (2001)

Germany

There is a fast emergence of large "Do-it-Yourself" supermarkets. In 2005, 2520 huge supermarkets (with a sales area of more than 1.000 m^2 each) existed. The ten biggest companies had an annual turnover of 17.7 Billion Euros. This represents 80 percent of the total turnover in "Do-it-yourself"-markets.

The three biggest firms in Germany are OBI, Praktiker and Bauhaus having a market share of 21.7 percent.

Thus the market appears less concentrated than in Spain but quite similar than in France:

- UK: B&Q (kingfisher without Castorama), Homebase, Wickes = 60,1 %
- Spain: Leroy Merlin, AKI, ATB = 57,2 %
- France: Castorama/Brico Dépot, Leroy Merlin, Domaxel = 21,7 %
- Italy: Bricocenter, OBI, Castorama = 5,1 %

Poland

There are no existing official statistics which describe distributors and wholesalers in construction sector. GUS (National Statistic Office) describes only wholesalers of construction products in Poland (table 26). In year 2000 there were 12 510 registered companies while in 2005 the number grow to 16 310 companies. Most of those firms offer a wide range of products.

Table 26: Number of distributors in Poland

Network of distributors	Market share	Comments
Supermarkets [do it yourself]	24%	Castorama 10%; Leroy Marlin [?2%]; Praktiker 3%; NOMI 3%;
Network wholesalers [wide range of products]	40%	This is network targeted to small and medium contractors and individual investors. Typically they offer quite wide range of products. Only specialised shops are electric one.
Other	36%	Usually private individually owned wholesalers and shops
Total revenue of sale	Approx. 18 000 000 PLN [4 500 000 €]	

Spain

Table 27: Annual survey of Trade 2004. Main Levels by type of variable and subsectors
(*Unit: Economical data in thousands of euros)*

	Wood and materials of construction	Wood, materials of construction and sanitary devices	Hardware store, plumbing and heating	Machinery for the construction
Number of Companies	3.542	15.169	4.551	1.025
Number of businesses	3.568	18.748	5.756	1.388
Turnover amount	294.168	21.766.725	8.528.788	4.249.732
Value of the outputs	271.963	5.623.039	2.247.327	1.089.291
Value added to market prices	191.345	3.315.835	1.482.808	726.070
Value added to the cost of the factors	190.307	3.286.953	1.471.133	718.513
Personnel Costs	54.196	1.972.748	954.182	407.075
Purchases and expenses in goods and services	100.067	18.737.766	7.212.015	3.606.111
Purchase of goods and services for the resale	22.885	16.475.774	6.463.407	3.248.719
Gross investment in material goods	15.425	668.679	230.702	142.747
Number of working personnel	4.803	99.030	38.970	12.114
Number of remunerated personnel	1.732	90.160	37.239	11.763

Source: Instituto Nacional de Estadística - Copyright INE 2006

Table 28: Annual survey of Trade 2004. Construction Distributors. Exploitation Results by type of variable and sub-sector.
(Unit: Thousands of Euros - Copyright INE 2006)

	Wood and materials of construction	Wood, materials of construction and sanitary devices	Hardware store, plumbing and heating	Machinery for the construction
1. Total wholesales and retail	9.021	21.306.610	8.419.137	3.859.881
2. Consumption of goods	9.778	15.780.405	6.253.311	3.193.727
3. Business volume for other concepts	285.147	460.116	109.651	389.851
4. Variation of stock of finished products and in course	0	13.214	-129	14.132
5. Works realized by the company for the immobilized one	0	11.768	388	2.608
6. Other income of management	847	115.200	43.976	57.775
7. Works realized by other companies	13.273	503.463	72.385	41.229
8. Value of the production (1-2+3+4+5+6-7)	271.963	5.623.039	2.247.327	1.089.291
9. Consumption of prime matters and other	13090	276029	28254	38110
10. Expenses in exterior services	64091	1983137	722236	320859
11. Other expenses of management	3437	48039	14028	4252
12. Value added to market prices (8-9-10-11)	191345	3315835	1482808	726070
13. Taxes linked to the production and to the products different from the VAT	1050	37829	14129	8052
14. Subsidies to the exploitation	11	8946	2454	494
15. Value added to the cost of the factors (12-13+14)	190307	3286953	1471133	718513
16. Personnel expenses	54196	1972748	954182	407075
17. Brute surplus of exploitation (15-16)	136110	1314205	516951	311437

Source: Instituto Nacional de Estadística -

Table 29: Annual survey of Trade 2004. Construction Distributors. Main coefficients by type of variable and sub-sector

	Wood and materials of construction	Wood, materials of construction and sanitary devices	Hardware store, plumbing and heating	Machinery for the construction
Occupied by company	1,4	6,4	8,4	11,6
Productivity (euros)	39.642,3	33.920,4	38.320	60.546,5
basic interprofessional salary (euros)	27.169,2	17.697,3	20.609,1	27.175,1
Rate of added value (%)	70	58,5	65,5	66
Rate of expenses of personnel (%)	28,5	60	64,9	56,7
Wage earners' rate (%)	36,1	91	95,6	97,1
Rate of stability in the employment (%)	92,9	77,5	82,1	86,3
Rate of female participation (%)	20,4	20,4	21,4	17,6
Rate of female wage-earning employment (%)	35,4	20,8	20,8	17,1
Rate of externality in the employment (%)	1,4	2,7	3	1,7

Source: Instituto Nacional de Estadística 2006

Synthesis on the chapter on products distributors

The tables indicate that:

- some manufacturers are also product distributors (e.g. case in Finland for most of the big manufacturers and in France – the leader Point P is a subsidiary of Saint-Gobain).
- competition between non specialists and specialists and/or retail and wholesale distributors is strong both for professional and non-professional customers.

The innovation in this sub-sector differs from that of contractors and manufacturers:

- most innovations concern the service,
- increase of e-commerce and exchange of information with suppliers

2.2 INDICATORS OF THE INNOVATIVE ACTIVITY

R&D expenditure and patents are often used as indicators of innovative activity. This is also valid for construction but other original indicators have been developed because of the specific project activity oriented of the construction sector.

One more time, the difference between the dual manufacturing-site activity aspects of the construction activity creates a rather contrasted situation.

Products created by manufacturers are intended to be more or less widely used in many different domains (even out of the construction sector). Constructions are very often, one of a kind project; some even say that constructors innovate at each new project which is considered as a (new) prototype.

As in any kind of project, the interest of involved actors is to minimise the risk they take in participating. Due to the long life time of a construction and to the “inherent innovative aspect” of any new construction, specific procedures have been developed in Europe to assess the performances of innovative products and processes.

Initial national assessment frameworks (Avis Technique in France, Technical Agreements in UK, ATG in Belgium ...), in most cases developed after World War II during the reconstruction period, have been in a deep changing process for some years due to European decisions.

Nevertheless, these procedures are linked to the construction sector innovative activity and the flow of these procedures is likely to be a good indicator of this activity.

As far as possible, we address the following points for each country:

- Expenditures in R&D
- Patents
- Assessment procedures
- Others such as technical expertise

2.2.1 Belgium

Patents

Table 30 indicates that 18,6% of the 2005 registered patents concern construction.

From these patents, 78% were on new construction parts such as concrete blocks, windows, …; 9% on technical items, mainly for ventilation and energy saving and the remaining 13% on new construction methods.

Table 30: Statistics on Belgian patents (2005)

BE	705		
BE construction	131		
% construction	18,6%		
Belgian applicants	98	131	74,8%
EU appl	30		22,9%
Non EU appl	3		2,3%
Belgian isol. inventors	49	131	37,4%
EU isol. inventors	5		3,8%
Non EU isol. inventors	0		
Belgian companies	49		37,4%
EU Companies	25		19,1%
Non EU companies	3		2,3%

Technical expertise

The contractors and architects can ask the BBRI for advice on practical problems in the field. Some 25 000 questions are treated every year. This gives a good view on the practical problems of contractors. The questions concern the fields mentioned in table 31.

Table 31: Statistics on BBRI technical advices

humidity	26%
Deformation	26%
Chemical and biological degradation	11%
View	8%
Rules and legislation	6%
Mechanical characteristics	5%
Dimensions	4%
Insulation (thermal, acoustics)	3%
Technical equipment	3%
Maintenance	1%
Other	9%

Technical assessment procedures

The quality of construction materials is assessed through the ATG (Aalgemene technische goedkeuring) procedure. Table 32 shows the repartition of subjects.

Table 32: Statistics on ATG procedures

	Sectors	Applications			Total approved
		2003	2004	2005	
Building	Construction systems	7	5	4	25
	construction	6	7	10	17
	roofs	24	29	22	150
	walls	67	71	71	199
	finishing	32	20	25	92
	equipment	30	31	17	71
	wood	26	10	15	135
	passive fire prevention	30	29	24	87
	natural stones	26	24	17	71
		248	***226***	***205***	***847***
Civil engineering	sealing	5	1	1	9
	metallic construction	0	0	0	0
	systems with wooden elements	0	0	0	0
	road construction	0	0	0	0
	road construction equipment	7	13	0	11
	draining	0	1	0	1
	systems with concrete elements	0	0	0	0
		12	***15***	***1***	***21***
Bdg/c iv eng	binders	2	0	0	1
	protection/reparation of concrete	6	7	7	24
		8	***7***	***7***	***25***
	TOTAL	***268***	***248***	***213***	***893***

2.2.2 Finland

Expenditures in R&D

The GDP share of R&D expenditure, in Finland was 3.5 % in 2004, nearly 5.3 billion euros. This was the highest share in the last 5 years. Companies share of R&D expenditure was 70% based on data collected from Statistics Finland. The companies in the construction sector expend 41 million € in 2003 and 27 million € in 2004. The highest share of these investments is expended in salaries (table 33).

Table 33 - R&D breaking of expenses for different sectors in 2003 and 2004

		Total expenses	Wages and salaries	Current expenditures *1	Acquired services*2	Machinery, equipment, buildings and, other investments
	year	mill. €				
Total R&D expense	**2003**	**3.527.9**	**1.746.2**	**800.3**	**697.1**	**284.4**
	2004	**3.683.5**	**1.910.0**	**1.249.1**	**376.4**	**147.9**
Agriculture, forestry and fishing	**2003**	0.7	0.4	0.1	0.2	0.0
	2004	1.0	0.6	0.1	0.3	0.1
Mining and excavations	**2003**	5.6	2.5	0.9	2.1	0.1
	2004	6.0	2.5	0.8	1.7	1.1
Manufacturing companies	**2003**	2.800.2	1 332.4	668.4	582.6	216.8
	2004	2.936.9	1 481.7	1.102.2	269.9	83.1
Construction	**2003**	**41.2**	30.1	4.6	5.5	1.0
	2004	**27.1**	15.8	5.7	4.1	1.5

Source: Statistics Finland

*1 materials, equipment, rents, others

*2 services directly linked to own R&D projects. Acquired entire R&D projects belong to Extramural R&D expenditures.

. According with Statistics-Finland the strong decrease in R&D expenditure, for the construction sector, in 2004, can have several explanations:

- a big change due to different R&D projects
- change in the enterprise structures which may cause R&D included in this group to move to a different industry
- changes in the answers for the statistics surveys by the big companies which may affect the total result. Change from answer as individual enterprise to group of enterprises, for example or subjectivity on the R&D definitions by new people in the companies.

The total number of contractors declaring R&D expenditure is very small (52) when compared with the total number (31 932) (table 34). Survey is done based on systematic sampling and not from the total of companies. According with statistics-Finland there is no systematic sampling for survey for companies with less than 10 employees. But the coverage is good for bigger than that. These are 52 out of a representative sample of 2091.

Table 34: Number and size of companies declaring R&D expenditures in 2004

Employees class	Companies declaring R&D exp.	Companies by employees class
0-9	4	29841
10-49	21	1890
50-249	17	177
>250	10	24
Total	52	31932
Source: statistics Finland http://tilastokeskus.fi/til/tkke/tau.html		

Table 35 refers to intramural expenditures. Statistics Finland collect also data on extramural R&D expenditure (Domestic R&D acquisitions, R&D acquired from abroad, grants, support for research institutes) but these are not published neither there are available data. That's why EU support indicator here is so low.

Table 35: Source of R&D financing for the construction sector companies (2003 and 2004)

				R&D expenditure (million €)	
				2003	2004
Own funding (including other domestic enterprises)				**36.0**	**23.8**
External funds	**Loans subsidized by government**	**Finnvera**		**0.2**	**0.3**
		TEKES, National Technology Agency		**0.9**	**0.9**
		Other		**0.1**	**0.0**
	Other external funds (grants, commissioned R&D)	**Government**	**TEKES**	**2.1**	**1.8**
			Ministry of trade and industry (except TEKES)	**0.1**	**0.0**
			Other government	**0.4**	**0.1**
		Other public funds (e.g. municipalities, SITRA, Finnvera		**0.0**	**0.0**
		Foundations		**0.0**	**0.0**
		Domestic enterprises 1(2)		**0.0**	**0.0**
		Organizations that provide services to enterprises		**0.0**	**0.0**
		Foreign enterprises 1)		**0.0**	**0.0**
		EU funds		**1.4**	**0.1**
		Other funding from abroad		**0.0**	**0.0**
Total				**41.2**	**27.1**
Source: Statistics Finland					

The construction product group, in Finland, was the 11th in R&D expenditure by the companies in 2004. Also among the highest investments are other product groups connected with the construction industries as the metal products.

IT barometer 2001[2] indicates, for the Finnish construction chain, the experienced advantages with increase use of IT in order of priority:

- Sharing information,
- Work done more quickly,
- Better communications,
- Faster access to information,
- Handling large volumes of data.

[2] The latest developments in communications and e-commerce – IT barometer in 3 Nordic countries

Patents

From the total patent applications between 2000 and 2003 (table 36), 82% of construction patents were submitted by companies. Table 37 concerns the total number of patent applications per domain and covers all types of applicants (e.g. company, ICT vendors, research institutes, etc.). These innovation indicators collected in the statistics show the general situation for R&D in the Finnish construction sector. However these do not allow detail analysis of the main innovation developed and demanded by different actors. Other sources as the IT barometer for the Nordic countries, innovation policy studies and the analysis of the subjects of on-going and planned R&D projects give further information.

Table 36: Number of company's patent applications by business line between 2000 and 2003

	2000		2001		2002		2003	
Business line	**Companies**	**Applications**	**Companies**	**Applications**	**Companies**	**Applications**	**Companies**	**Applications**
Industry total	308	1 343	296	1 137	323	1 093	272	1 032
Food industry	17	28	10	23	15	30	8	14
Wood processing industries	18	46	20	52	25	65	21	57
Chemic industry	36	126	34	102	45	99	36	92
Metal and machinery	131	526	125	467	142	509	117	475
Electronics	73	561	69	419	64	336	61	355
Other manufacturing	29	51	32	62	27	43	27	37
Electricity, gas and water maintenance	1	1	3	3	2	2	-	-
Construction	17	19	19	23	21	26	7	10
Warehouse and retail	49	81	54	75	50	79	47	65
Transport, storing and communications	10	100	14	94	15	64	18	65
IT services	41	64	61	94	53	87	39	60
Research and development	25	99	30	118	30	90	23	115
Other Services	88	146	104	176	83	147	84	132
Other lines of business	33	45	35	55	33	46	37	47
Companies total	572	1 898	616	1 775	610	1 634	527	1 526
Source: Statistics Finland								

Table 37: national and foreign patents applications in 2002 to 2004

	2002			2003			2004		
	National	**Foreign**	**Total**	**National**	**Foreign**	**Total**	**National**	**Foreign**	**Total**
Commodities	302	33	335	397	50	447	222	15	237
Work procedures	435	27	462	295	26	321	444	27	471
Chemistry and metallurgic	183	50	233	177	15	192	160	29	189
Textiles and paper	178	13	191	106	7	113	155	19	174
Construction techniques	154	7	161	152	23	175	133	4	137
Machinery construction, lightning, heating, weapons and explosives	207	20	227	176	35	211	199	18	217
Physics	278	17	295	431	31	462	275	23	298
Electric engineering	419	49	468	239	27	266	422	80	502
Total	2 156	216	2 372	1 973	214	2 187	2 010	215	2 225
Source: Statistics Finland http://tilastokeskus.fi/til/pat/tau.html									

Technical assessment procedures

Table 38: Technical procedures (RT cards) issued by the Building Information (Rakennustieto) between 2003 and 2006

General	
Construction economy, investments	2
Construction physics	4
Construction protection and isolation	5
Construction Projects	
General construction project	6
Construction project work	4
Construction quality requirements	6
Construction design and building specification	6
Construction contract documents and forms	2
Buildings use and maintenance	2
Building materials and equipments	
Wood and timber	1
Building materials and equipments	1
Brick, tile	5
Fixtures, fittings	2
Warming and ventilation	
Ventilation and air-conditioning	5
Water treatment and waste management	
General	1
Building construction	
General construction	1
Foundations	2
Vertical design and framework	9
Basal construction	2
Surface finishing: floors, walls	3
Roof covering	5
Premises, sites and transportation	
Premises, general	1
Manufacturing and transportation premises	2
Sports premises	1
Land use planning	1

Other innovation indicator(s)

Main universities and professional training agents are indicated in table 39. Table 40 indicates the number of students graduated in the Helsinki University of Technology in 2005.

Table 39: Main Finnish universities and professional training agents

Universities	
	Areas
HUT Helsinki University of Technology	Civil and environmental engineering Architecture Building economics
TUT Tampere University of Technology	Civil Engineering and Architecture
University of Oulu	Architecture
Professional Training	
	Areas
AEL – Centre for Technical training	Real estate management, refrigeration and construction technology
Betoni	Concrete
ProMan-net	Project planning and management
The real estate education and training institute in Finland	Real Estate management
RT – Confederation of Finnish construction industries	Construction
RIL Association of Finnish Civil Engineers	Civil engineering

Table 40: HUT graduated students in 2005

	Graduated		Licence		Doctors	
Departments	**total**	**Women**	**total**	**women**	**total**	**women**
Architecture	**37**	**20**	**2**	**2**	**3**	**1**
Material science and engineering	**27**	**10**	**3**	**0**	**4**	**2**
Civil and Environmental engineering	**70**	**34**	**11**	**2**	**5**	**1**
Degree programmes						
Architecture	**27**	**13**				
Real Estate Economics	**13**	**8**				
Material science and engineering	**33**	**12**				
Civil and Environmental engineering	**64**	**32**				
Source: HUT students union						

2.2.3 France

Patents

The building and construction industry is referred to in different patents categories. Table 41 gives an indication of the patent flows in 2003 and 2004.

Table 41: Patents in the construction sector

Sector	**2003**		**2004**		**rank**
	Number	**%**	**Number**	**%**	
Buildings	355	37	386	37	1
Windows and doors	114	12	158	15	3
Hydrology and foundation	93	10	72	7	
Construction of roads and rail	122	12	103	10	
Water supply	51	5	56	5	
Metal works	191	20	236	22	2
Mine	43	4	44	4	
Total	969	100	1055	100	

Source: INPI, 2005 (National patent office, www.inpi.fr)

Technical assessment procedures

All the actors need to anticipate the performances of buildings parts and equipments. Two assessment procedures can be used:

1. the Appréciation Technique d'expérimentation (Atex), one-of-kind innovative project assessment (the "antechamber" of Avis Technique) (table 42)
2. the Avis Technique (AT), Technical advices that concern manufactured construction products or processes (table 43).

Table 42: Number of Atex assessments

Domain	Number of 2005 assessments	Number of 2004 assessments
Building structure	13	14
Building envelope & floor covers	49	79
Energy applications	7	9

Source: CSTB (www.cstb.fr)

Table 43: Breakdown of Avis Techniques by category

Category	**Registered 2005 AT**	**Registered 2004 AT**
Concrete parts and fixing	26	14
Light buildings, facades and partition	96	103
Structures: walls and floors	31	36
Roofing, tiling, water tightness	176	118
Windows and frames	77	62
Water tightness on vertical parts	15	36
Partition walls, indoor insulation and ceilings	72	80
Plastic floor cover and associated products	72	63
Floor tiling, wall covers and associated products	12	61
HVAC and sanitary	152	114
Specific masonry products and processes	22	29
Pipe networks	15	10
Water treatment	7	24
Specific insulation systems	46	12
TOTAL	819	762

Source: CSTB (www.cstb.fr)

2.2.4 Germany

It is difficult to obtain precise information regarding innovation activities for economic sectors. However, a brand-new study by the “Kreditanstalt für Wiederaufbau” (a bank group at Frankfurt) which has just been published can provide some interesting data. The study did a survey asking for the ratio of enterprises which have introduced innovation during the last three years.

Results show that innovation activities seem to be lower in construction industry than in other economic sectors. The ratio of enterprises with such innovation activities varied in manufacturing between 51 percent and 62 percent, depending on the field of manufacturing. Knowledge intensive services had an innovation ratio of 47 percent and the enterprise group belonging to “other services” had 38 percent.

Construction industry showed a rate of 30 percent. Asking for the kind of innovation activities, construction again showed to have a lag compared with the other economic sectors. Product innovations (introducing new products successfully) proved to have the highest ratio with 21 percent. Process innovations came then with 15 percent and new market innovations (introducing a new market version) followed with 3 percent.

2.2.5 Ireland

SMES are not the main drivers of the Irish economy and growth is strongly tied to large foreign-owned subsidiaries. A characteristic of this support is that only a very small proportion of State aid is focused on innovation. “Only 11% of all financing goes to newer forms of innovation support. About a half, 5% is provided in the shape of action capitals. A similar amount is spent on management development and support. 1% finally goes to 'in-company training' of personnel.”

Yet this is a considerable improvement on historical levels of R&D expenditure. Overall investment in R&D in Ireland had increased three fold during the 1990s. Business expenditure on R&D had reached IR£917m in 2001. But for the most part this was generated by foreign affiliates. As the Irish action plan on R&D 2003 states: “One third of foreign affiliates in Ireland (300 enterprises) are active in R&D. These firms account for two thirds of all business R&D. Of these 50% spend less than IR£500,000 annually, 119 spend more than IR£5m annually and account for two thirds of all R&D performed by Irish foreign affiliates in Ireland. Of the indigenous enterprises only one third has some expenditure on R&D with 85% spending less than IR£500,000 per annum. Only 26 of the indigenous enterprises have expenditure of more than IR£2m annually.” Overall the report notes that if State expenditure on science and technology in the EU at 1.9% of GDP lagged behind the US at 2.7% of GDP and Japan at 3.1% GDP, then Ireland was well below the EU R&D average at 1.4% of GDP.[3]

[3] State expenditure on Science and Technology 2001 : Vol two – The research and Development Element of the Science and Technology Budget Dublin Forfas 2003 (These reports for the first time presented an estimate of business and public sector R&D investment as a separate item) ERA 3% initiative – Review of Industry potential to increase R and D to 2010 PA Consulting Group report to Forfas Public Procurement for Increased Innovation Jacobs and Associated report to Forfas . Forfas 2003

The fate of construction

During the late 1980s the central government body supporting research into construction-related technologies together with NGO certification facilities were closed down. These State sponsored units had been linked to similar European based state bodies and their closure meant a significant loss of public sector know-how which could have informed political understanding. It would appear that, instead, uninformed Ministerial decisions were made as to the future direction and dimensions for R&D in construction which marginalised the sector. The acceleration of demand in the domestic build sector, which began in the 1980s and continues today, meant the industry faced relatively few challenges that could have led to R&D becoming a high priority. Hence there was a conspicuous lack of construction industry comment or lobbying when government chose to prioritise only two R&D areas in the wake of the Forfas report.

Despite the evidence of massive transformational capability in the education and training sectors since the 1970s, much of which was supported by EU-funded programmes, this was down played and the report committed Ireland to a strategy of external sourcing of new knowledge. As the Technology Foresight report stated, the two key technologies (bio and ICT) required new skills and, in particular, the development of a cadre of world class Research personnel. Attracting international expertise into Ireland in the key technology areas would be necessary if those sectors were to flourish.

2.2.6 Poland

Patents

The building and construction industry is referred to in different patents categories. Table 44 gives an indication of the patent flows in 2004 and 2005.

Table 44: Patents in the construction sector

Sector	2004		2005		rank
	Number	%	Number	%	
Buildings	56	30	49	24	2
Windows and doors	61	32	38	19	3
Hydrology and foundation	3	2	26	13	
Construction of roads and rail	14	7	18	9	
Water supply	9	5	12	6	
Metal works	10	5	9	4	
Mine	36	19	52	25	1
Total	**189**	**100**	**204**	**100**	

Source: UPRP (National patent office, http://www.uprp.pl/wydawnictwa/)

2.2.7 Spain

Patents

Table 45: Patent requests and patents conceded in 2003

	National	European	PCT	Euro PCT	PCT in National Phase	Total
Patent requests	3.081	52.000	92.089	92.000	89	147.170
Patents conceded	1.910	21.395	-	-	27	23.332

Source: COTEC, 2005 (COTEC is a Spanish Foundation for technological innovation, a foundation from company Origen)

Table 46: Patent requests and patents conceded in 2004 (preliminary numbers of the Spanish Office for Patents and Trademarks (OEPM))

	National	European	PCT	Euro PCT	PCT in National Phase	Total
Patent requests	3.100	55.327	120.701	120.100	84	181 325
Patents conceded	1.981	19.903	-	-	53	21.937

Source: Oficina Española de Patentes y Marcas, 2005 –

There are no numbers per sector available. The OEPM only divides the patents in very broad 'technical sectors':

A. Normal necessities of life,
B. Diverse industrial techniques; Transport,
C. Chemistry; Metallurgy,
D. Textiles; Paper,
E. Fixed constructions,
F. Mechanics; Lightning; Heating; Weapons, Explosives,
G. Physics,
H. Electricity.

Given the fact that patents regarding construction can be classified in several of these sectors, no numbers can be given of the share of construction in the number of patens requested or conceded.

Expenditure en R&D

The effort of the construction sector from 1992 to 2002 hardly improved when measured in the amount of money spent on R&D divided by the added value (table 47).

Table 47 :R&D Effort in the construction sector

	1992	2000	2002
R&D Effort Construction (R&D spending / added value)	0,04%	0,07%	0,06%

Source: COTEC, 2005

The total (internal) spending on R&D in Spain was 4.443,4 million € in 2003 [COTEC, 2005] and the share of the construction sector was 1.6% corresponding to 71,1 million €. What these figures do not show is the spending in sectors like the chemical industry, machinery & transport material or IT.

Number of innovative companies

The number of innovative companies in the construction companies in the period 2001-2003 was 15,6%, compared to 19,4% of innovative companies in the total economy and 24,7% in industry in general [COTEC, 2005]. When combining these percentages with the numbers of the SEOPAN report [SEOPAN, 2005], this would mean that some 61.000 companies in the construction sector were innovative in the aforementioned period.

Quality and environmental certification

The construction sector counts with 18% and 17% of the quality and environmental certificates respectively in Spain [COTEC, 2005]. These percentages correspond to some 2.340 and 415 certificates respectively.

Synthesis on the chapter “innovation indicators”

The construction sector is often perceived as a laggard for innovation compared with other industries (e.g. R&D expenditures are very small, percentage of innovative companies is also lower than in the rest of the economy) but it appears that:

- the number of patents is as high as in other sectors (e.g. In France 1055 in 2004 – 893 for pharmacy and biotechnology)
- technical assessment procedures for innovative products and processes (specific to the construction sector) and technical advices for manufactured products confirm this innovative activity.

2.3 THE ROLE OF FUNDING PROGRAMMES AND PUBLIC SUPPORT STRUCTURES

The organisations supporting the innovation framework appear to be a key element in the innovation process. Indeed firms innovate in interaction with other actors: suppliers, customers, competitors but also universities, government agencies, research institutes…

Public actors often provide financial resources to entrepreneurs either through innovation support targeted funds or through R&D support funds.

In some countries, private funding can also be identified.

The following information uses a common data collection framework (table 48).

Table 48: framework for data collection about funding organisms

Name of the organisation	
Web site	
Objectives/key elements	
Financial Resources	
Contribution to innovation	

2.3.1 Belgium

Table 49 Construction specific innovation support structure

Name of the organisation	BBRI Belgian Building Research Institute
Web site	www.bbri.be
Objectives	Collective research in the field of construction, information to contractors and architects
Financial Resources	Ca 25 000 000 €/year
Contribution to innovation	Research, management of innovation projects, co-ordination of the national technology platform
Name of the Organisation	BRRC (Belgian Road Research Centre)
Web site	www.brrc.be
Objectives	Collective research in the field of road construction, information to contractors and architects
Financial Resources	10 000 000 €/y
Contribution to innovation	Research, management of innovation projects, co-ordination of the national technology platform
Name of the organisation	ANRE
Web site	www.energiesparen.be
Objectives	Management of the Flemish politics in matters of energy and natural resources
Financial Resources	
Contribution to innovation	Financial aids for sustainable energy systems and demonstration projects

Table 49 (continued) Construction specific innovation support structure

Name of the Organisation	Grindfonds
Web site	www.grind-limburg.be
Objectives	Promote the search for alternatives for gravel
Financial Resources	4 200 000 € (end 2004)
Contribution to innovation	Financial support for innovative projects contributing to a diminution of the use of gravel

Table 50 Non construction-specific innovation support structure

Name of the Organisation	IWT
Web site	http://www.iwt.be
Objectives	Funding of industrial scientific technological R&D Services with regard to technological transfer and innovation
Key Elements	60 million for R&D-projects 15 million for Innovation projects SMEs 30 million for Strategic Basic Research 7 million for HEI 30 million for Cooperative Innovation Networks Measures of Flemish Government (specific actions)
Financial Resources	230 million €
Contribution to innovation	Promotes R&D activity and technical innovations as well in collective centres as in individual companies Clients 150 innovative Large enterprises / year 500 SME projects / year Network of intermediaries 250 advisors in the field
Name of the Organisation	Fund for Scientific Research (FWO)
Web site	www.fwo.be
Objectives	Funding of scientific research
Key Elements	Individual researchers (50 million euros) Supporting prominent research teams (50 million euros) Promoting scientific contacts (2 million euros)
Financial Resources	102 million €
Contribution to innovation	Funding of research
Name of the organisation	DGTRE
Web site	www.recherche-technologie.wallonie.be
Objectives	Promotes and finances innovation in Walloon industry. It has special programmes for SMEs.
Key Elements	Providing information and financial support, establishing contacts with technical partners, assisting in partner search to set up industrial and commercial partnership
Financial Resources	140 Mio €
Comments	Promotes R&D activity and technical innovations as well in collective centres as in individual companies

2.3.2 Finland

Table 51: non construction-specific innovation support structure

Name of the Organisation	**TEKES Finnish Funding Agency for Technology and innovation**
Web site	www.tekes.fi
Objectives	TEKES is the main public financing and expert organisation for research and technological development in Finland. Tekes finances industrial R&D projects as well as projects in universities and research institutes. The primary objective is to promote the competitiveness of Finnish industry and the service sector by assisting in the creation of world-class technology and technological know-how. Specifically, Tekes' activities aim to diversify production structures, increase production and exports, and create a foundation for employment and social wellbeing.
Key Elements	Especially it promotes innovative, risk-intensive projects. High support of SMEs.
Financial Resources	Tekes funds come from the state budget via the Ministry of Trade and Industry. Tekes has a budget of 400 million euros, a source of funding for 2,000 projects annually. Annually Tekes' technology programmes cover approx. ten per cent of the R&D investments in Finland. General technology programmes where construction sector projects can be included: - Energy, environment and construction technologies 72 million euros. - Product and production technology 86 million euros. Construction specific technology programmes: CUBE – The Building Services Technology Programme 2002–2006 Takes funding in 2004 5 M€ Estimated total cost 40 M€ Participating companies 200 Participating research units 17 Infra – Construction and Services Technology Programme 2001–2005 Takes funding in 2004 3.8 M€ Estimated total cost 30 M€ Participating companies 126 Participating research units 9 Sara – Value Networks in Construction 2003–2007 Takes funding in 2004 4.8 M€ Estimated total cost 33 M€ Participating companies 98 Participating research units 9
Contribution to innovation	Finances industrial R&D projects and its a active element in the diffusion of innovations of out coming innovations.
Name of the organisation	**VTT - Technical Research Centre of Finland**
Web site	www.vtt.fi
Key Elements	VTT has a wide knowledge base covering almost all areas of scientific research.
Objectives	VTT is an impartial expert organisation. It produces research, development, testing and information services to public sector and companies as well as international organisations. VTT is the biggest contract research organisation in Northern Europe. . Its objective is to develop new technologies, create new innovations and value added thus increasing customer's competencies. With its know how **VTT Materials and Building** (previous VTT Building and Transport) develops research in the following areas: Property, workplace, housing and geoengineering Building materials and products Indoor climate and building services Building construction Communities, infrastructures and networks Product approval and certification Testing and inspection certification Expert consultation Information services Innovation studies Development of business operations

Table 51 (continued): non construction-specific innovation support structure

financial Resources	Total turnover 218 M€ external income 151 M€ (70% of turnover) basic governmental financing 68 M€ (30% of turnover) income from abroad 31 M€ (14% of turnover) In 2004 33 M€ were expended in self-financed projects Self-financed research consists of technology-based strategic research projects aimed at developing competitiveness and acquiring knowledge and expertise to meet the future needs of customers. VTT Building and transport 2004 turnover was 36.2 M€
Contribution to innovation	VTT is an integral part of Finland's innovation system by creating and applying new technologies. It also speeds up the exploitation of new technology in the corporate sector. . During the past 10 years: 959 patent applications 1 873 notices of invention 45 536 publications
Name of the Organisation	**SITRA Finnish National Fund for Research and Development**
Web site	www.sitra.fi
Objectives	The Finnish National Fund for Research and Development (Sitra) is an independent public foundation under the supervision of the Finnish Parliament. Sitra's aim is to be a respected partner in building a knowledgeable and innovative society. Sitra's operations have been focused into six programmes, each of which consists of various projects and measures. The programme areas are: Innovations Health Care Food and Nutrition Environment Russia India The programmes utilise a wide array of methods, including research and education, innovative projects, business development, venture-capital investments and other corporate funding. The methods used vary from programme to programme.
Key Elements	Investments in companies which bring innovation in key areas
Financial Resources	Sitra' s operations are funded with endowment capital and returns from capital investments. Sitra will only invest in companies that operate in one of its programme areas. «In 2004 SITRA funding decisions were 28 million € Sitra reported a net profit t of € 7.6 million
Contribution to innovation	Sitra conducted research on technological and social innovation processes,
Name of the Organisation	**Suomi Akademia**
Web site	http://www.aka.fi/
Objectives	The Academy of Finland provides funding for high-level scientific research acts as a science and science policy expert and works to strengthen the position of science and research. More than 3 000 research professionals are engaged in Academy-funded projects at universities and research institutes. The Academy's operation covers all scientific disciplines. Main focus is on: - supporting the development of innovative research environments - promoting professional careers in research - advancing gender equality in research - strengthening international cooperation and interaction The Academy has four Research Councils that decide on the allocation of funding within their respective fields. Construction sector research is within the Research Council for Natural Science and Engineering. On-going programmes: Baltic Sea Research Programme, BIREME (2003-2005) Business Know-how, LIIKE2 (2006-2009) Environment and Law Research Programme, ENVLAW (2005-2008) Environmental, Societal and Health Effects of Genetically Modified Organisms, ESGEMO (2004-2007) Future Electronics, TULE (2003-2006) Health Services Research, TERTTU (2003-2007) Industrial Design (2003-2006) Information Technology in Mechanical and Automatic Engineering Research Programme, KITARA (2005-2009) Life as Learning Research Programme, LEARN (2002-2006) Microbes and Man Research Programme, MICMAN (2002-2006) Neuroscience, NEURO (2005-2009) Russia in Flux. RUSSIA (2004-2007) Social Capital and Networks of Trust, SOCA (2004-2007) Systems Biology and Bioinformatics, SYSBIO (2004-2007) Wood Material Science Research Programme (2003-2006)

Table 51 (continued): non construction-specific innovation support structure

Key Elements	Funding for projects and researchers
Financial Resources	The Academy of Finland operates under the administrative sector of the Ministry of Education. In 2004, the funding for research amounted to 208 million euros. The Academy accounted for 14 per cent of government R & D spending. The Research Council for Natural Science and Engineering. Funding decisions in 2004 accounted 65 000 €
Contribution to innovation	The Academy of Finland has a range of different funding instruments for different purposes: it provides funding for research projects, research programmes, centres of excellence in research, researcher training, international cooperation as well as research posts for Academy Professors and Academy Research Fellows. It also promotes a wide dissemination of scientific results to the society

Table 52: Private support structure

Name of the Organisation	RAKLI - The Finnish Association of Building Owners and Construction Clients
Web site	www.rakli.fi
Objectives	RAKLI is an interest group and trade association representing the most prominent real estate owners, investors and service providers in Finland. RAKLI represents its members in various property ownership matters concerning legislation, taxation and common policies. The association contributes to the implementation of best practices in Asset, Property, and Facilities Management, and promotes application of high standards in building industry processes, real estate market information and benchmarking. RAKLI provides development services that aim to increase life cycle productivity of real estate operations. R&D activities are focused on following topics: - improving market information by creating connections between financial and real estate key figures, financial decision makers and real estate actors - implementing the International Accounting Standards by developing Finnish real estate valuation standards and accounting practices - improving the securitization possibilities of real estate related assets through special legislation and tax incentives - developing business processes to meet the needs of the clients by offering customized services - converting environmental issues related to production and maintenance of facilities into a positive marketing argument: environmental know-how is seen as an asset in domestic and international real estate marketplaces - developing internal business processes in procurement, contracting, commissioning, risk assessment, standards and rules as well as other traditional areas of operation.
Key Elements	It provides a network for real estate professionals to discuss mutual challenges, exchange ideas, and share experiences and knowledge
Financial Resources	Approximately 50 % of the annual turnover of the association is allocated to the R & D undertakings.
Contribution to innovation	Support in R&D activities, networking and information transfer is available for the members.
Name of the Organisation	**RT - The Confederation of Finnish Construction Industries**
Web site	http://www.rakennusteollisuus.fi/
Objectives	RT is the joint interest organisation of building contractors, special contractors and the construction product industry. RT is a central federation, through which about 2000 companies are organised. The member companies employ close to 50 000. The joint turnover of the companies is about 10 billion euros. It supports the operational viability of its member companies by influencing legislation and the regulations issued by the authorities that concern the construction industry and entrepreneurship. The confederation monitors development in its own industry and, as a leading expert, it endeavours to influence decisions that concern economic policy, land use policy, regional policy, and industrial policy. The central questions include competition and contractual terms, environmental issues, healthy competition, and efficient action against the black market. RT aims to make research and development part of the industrial operations and strategy of ever more companies operating in the construction industry. It endeavours to do so by supporting the development of the technological competitiveness and productivity of its member companies. Exercising influence effectively plays a key role in this effort: on the one hand on national decision-makers and persons of influence and on the other hand on programmes at the EU and international level in order to ensure the prerequisites for R&D in the construction industry. IRT has actively support development of technology for 20 years.
Key Elements	The confederation publishes research results on such things as business cycles, profitability, and foreign trade in the industry; the results are used as the basis of decision-making and policy statements.
Financial Resources	Investment money in own projects is about 1 million euros/year.
Contribution to innovation	The confederation operates as the engine for R&D projects.

2.3.3 France

Table 53: construction-specific innovation support structure

Name of the organisation	Centre Scientifique et Technique du Bâtiment (CSTB) is a centre for research, consultancy, evaluation and knowledge dissemination. It is a state-owned industrial and commercial corporation under the control of the Ministry of Housing. 635 people in all, among which 50% engineers and researchers, work at CSTB.
Web site	www.cstb.fr
Objectives	CSTB comprises a wide range of prominent experts, specializing in building materials and techniques, equipment, safety, thermal energy, acoustics, aerodynamics, lighting, environmental and health issues, advanced communications technology, as well as economics and sociology. As a public industrial and commercial corporation, CSTB operates independently of its partners in the building industry, such as construction professionals and manufacturers.
Financial Resources	17,5 million euros dedicated to research / 25,6 million euros dedicated to technological activities (2004) 3 million euros for PPP research programmes
Contribution to innovation	Development of innovative products and of assessment methods
Name of the Organisation	The LCPC (French Public Works Research Laboratory) is a national organization for applied research and development. It's status is that of a Public Scientific and Technical Research Establishment (EPST) and it is run jointly by the Minister for Public Works and the Minister for Research
Web site	www.lcpc.fr
Objectives	The LCPC has long-standing recognition in both France and abroad in the area of civil engineering and now wishes to increase its presence in the areas of urban engineering, the safety of infrastructures and their operation, the environment and risk prevention
Financial Resources	10.3 million euros dedicated to research among which 1.1 million euros for Incentive action programmes
Contribution to innovation	Development of innovative products and methods
Name of the organisation	Agence de l'Environnement et de la Maîtrise de l'Energie (ADEME)
Web site	www.ademe.fr
Objectives	Support R&D and promote the development of environmental friendly technologies for buildings. Develop expertise, advisory services and action to influence the behaviour of actors in the economy.
Financial Resources	47,16 million euros in 2004 dedicated to research programmes
Contribution to innovation	Support the development of design methods, of new products. Dissemination of results.
Name of the Organisation	Plan Urbanisme Construction et Architecture (PUCA)
Web site	www.chantier.net
Objectives	To support advanced practices, experimentation and to stimulate innovation in the building sector (urbanism, architecture and construction technology and organisation). A permanent team of 40 people in charge of programmes launching, projects selection, networking and programmes assessment. One of the main tools is experimentation on site.
Financial Resources	7 million euros in 2004 to support experimental operations
Contribution to innovation	Generation of new ideas and dissemination of results of experimentation and work groups.
Name of the Organisation	Réseau Génie Civil et Urbain (RGC&U) - Program to support advanced practices and experimentation
Web site	www.equipement.gouv.fr/recherche/default.htm
Objectives	Stimulate co-operation between construction related industries and public laboratories. The networks promotes the presentation of innovative projects and selects (gives a label) to some projects which are not financed by the network.
Financial Resources	Not available
Contribution to innovation	Co-operation between construction industry and public laboratories.

Table 53 (continued): construction-specific innovation support structure

Name of the Organisation	Centres Techniques Industriels (CTI - concrete products, bricks and tiles, wood, etc…) Program to support performance and quality improvement
Web site	www.reseau-cti.com
Objectives	Solve production problems of the manufacturers which are affiliated to the technological centre. Develop innovative production methods (Each industrial branch has his own centre).
Financial Resources	Depends on construction industrial branches (financing from a tax based on the activity)
Contribution to innovation	Patents, development of production methods.

Table 54: non construction-specific innovation support structure

Name of the Organisation	OSEO ANVAR
Web site	http://www.oseo.fr
Objectives	Promotes and finances innovation in French industry particularly for SMEs. It facilitates the emergence of new products and processes in all fields of activity. Help entrepreneurs who want to create a firm
Key Elements	Providing information and financial support, establishing contacts with technical partners, assisting in partner search to set up industrial and commercial partnership.
Financial Resources	About 4% of the budget is dedicated to construction related innovation projects
Contribution to innovation	Capacity to support the development of selected projects. Helps for the diffusion of innovations.
Name of the organisation	Agence Nationale de la Recherche et de la Technologie (ANRT / CIFRE) - Program to support taking up of systems and procedures
Web site	www.anrt.asso.fr
Objectives	Facilitate the employment of young researchers within the frame of co-operation with public laboratories.
Key Elements	Incentive fiscal mechanisms.
Financial Resources	Non available.
Comments	Promote R&D activity in SME companies.

2.3.4 Germany

For many, many years a support scheme existed which should provide financial aids for people ordering the construction of their new house. This funding program was designed (i) to help households to master the building costs of new houses, (ii) to enhance the ratio of home owners, and (iii) to foster the demand for the construction industry. Financial benefits were substantial: E.g. a family with two kids having an annual income of less than 120.000 Euros received 32.000 Euros over a period of 8 years, 4.000 Euros per year paid automatically by the tax office cash once a year. Public authorities did not ask for the price of the new house, 100.000 or 1.000.000 did not make a difference. Customers of “used houses” received half of the sum under similar conditions.

In 2003 the “red-green” governments changed the practice and cut the funds by about 50 percent. In the meantime, the new “black-red” government decided to reduce this support scheme further or to abolish it completely for saving money wherever possible. However, this political instrument was always controversial. It provides support to local constructions firms, and households.

Another policy instrument dedicated to the construction industry was the existence of diverse programmes and incentives e.g. to implement solar energy or to replace old housing elements by new ones (e.g. windows).

2.3.5 Ireland

Innovation support structures are not specific to the construction sector. The three main players that give support to Irish corporates are: (A) the Science Foundation of Ireland (SFI), (B) third level education institutions and (C) Enterprise Ireland (EI).

Science Foundation of Ireland

The focus of SFI funding has remained constant to the present. As such there is no evidence of this initiative being of support to the Built Environment sector.

Third Level Institutions: universities as factories in the knowledge economy

Significant national R&D capability is now located in Ireland's the third level education sector which consists of six university colleges within the National University of Ireland (NUI) and five Institutes of Technology. Two players dominate: University College Cork and Trinity College Dublin. Given the bias of R&D funding towards biotechnology, nano technology and ICTs, it is in these areas that R&D capacity has grown. The recipients of Enterprise Ireland support reflect the focus on these three areas. Some of the CSETs supported by the SFI have grown very fast indeed. For example, the AlimentOry Pharmabiotic centre in Cork now employs 141 full time researchers. The centre now attracts significant industry support. For example, the Cork centre has recently attracted a €13.7 million investment from Glaxo Smith Kline. Such industry funding is generally tied to clearly defined pre commercial outcomes. The Glaxo Smith Kline agreement is such an investment contract. Scientists traditionally have no enterprise and commercial training. Enterprise Ireland has attempted to plug this gap by funding commercialisation know-how through developing campus-based incubators as well as by developing or reinforcing existing industrial development offices in the third level institutions.

Enterprise Ireland

The R&D support remit of Enterprise Ireland, the main public sector-industry NGO, is determined by Government and is restricted to companies involved in overseas trading. Developing competitiveness and niche global companies has become a priority in the face of growing international pressure. The underlying model assumes companies based on manufacturing plant type companies which does not fit well with the construction sector. In addition, with a sustained and strongly profitable domestic market, Irish building corporates have not on the whole -- and there are some notable exceptions -- been involved in the export of tangible goods or been focused on defined R&D activities and so they have fallen outside the remit of Enterprise Ireland.

EI support can be grouped roughly under two headings: that of company oriented support and that of work based around third level education institutions based on R&D commercialisation. For eligible companies Enterprise Ireland offers support in six areas:

- productivity improvement
- R&D within your enterprise
- R&D collaboration with third-level colleges and with other companies
- research commercialisation
- international R&D collaboration
- technology acquisition

By improving competence in the first three areas EI's belief is that companies will significantly improve effectiveness and profitability. "The first three items combine the basics of benchmarking and world class business techniques in a proven, effective form for small and medium sized companies. By taking a core of benchmarking and world class business techniques, companies can quickly achieve large and significant gains and improvements in performance."

Benchmarking: Enterprise Ireland offers support in the development of quantitative and qualitative systems which will allow companies to:

- Assess current performance
- Compare performance with that of equivalent companies in Ireland and Europe
- Interpret and analyse the results achieved
- Identify performance gaps against best practice
- Help with improvement plans to close the gaps
- Monitor and evaluate the results of your improvement plan.

Enterprise Ireland will assist in:

- the quantification in financial and commercial terms of the potential for improvement in your business;
- tailoring an implementation programme and the necessary training that this requires so that the maximum benefits can be achieved effectively and efficiently.

This will be achieved via a diagnostic audit of current practice and performance, with Enterprise Ireland developing a report recommending an implementation programme to the company in order for it to achieve maximum operational improvement at a pace the business can manage The scheme underwrites a proportion of the costs required for technical and training support and in company project management to facilitate the implementation.

Some budget lines exist to support SMEs. The Productivity Improvement Fund (PIF) is designed to assist Enterprise Ireland and Shannon Development's SME clients to achieve greater competitiveness by improving their export potential.

This fund is open to existing Enterprise Ireland and Shannon Development clients:

- that are SMEs which meet the requirements of the Industrial Development Act 1986.
- have been trading (i.e. generating sales) for at least five years before the date of application.
- in the case of a company that is now an SME and has been taken over or the subject of an management buy-out (MBO), the new company will be eligible if the previous entity was trading for at least five years (as defined in the preceding paragraph) prior to the end closing date for applications.

It is intended that through this support a sustainable improvement in productivity will be embedded in recipient companies thereby establishing a base from which they can develop their exports.

Activities that can be supported under this competitive fund include capital, technology acquisition and training/management development that will lead to a sustainable improvement in productivity within the company. There are however limits to funding available. Where a company applies for two of the above categories within one project, the total available funding from the PIF will be €350,000, i.e. the maximum for capital & technology acquisition is €200,000 and the maximum from training is €150,000. Where a project includes both capital and technology acquisition, the maximum funding available will be €200,000.

Table 55: the Productivity Improvement Fund (PIF)

	Max Funding	**Funding Type**	**Min. company Spend**
Capital	€200,000	Grant/repayable grant	€150,000
Technology Acquisition		Grant ***	€50,000**
Management Development	€150,000	Grant	€25,000*
Other Training		Grant	

*From the 13th January 2006, the minimum project spend on training has been reduced from €50,000 to €25,000. ** From the 21st July 2006, funding for Technology Acquisition will be in the form of grant, not grant/repayable grant. *** From 21st July 2006, the minimum spend for Technology Acquisition will reduce from €150,000 to €50,000.

Funding is in the form of grant/repayable grant for capital, 50% of which will be repayable three years after each grant cheque is issued. Enterprise Ireland/Shannon Development will send out an invoice for the repayable monies. Normal debt collection procedures will apply. There is no repayabilty for technology acquisition, management development or training activities. In these cases, funding is in the form of a grant. Funding is biased towards the Border, Midland and Western (BMW) region, and the South East, South West and Mid West regions. The maximum funding available per region is given in the table 56.

Table 56: regional funding (PIF)

Maximum Limit By Region	**Capital & Technology Acquisition**	**Management Development**	**Training**
BMW	50%	70%	45%
SE/SW/MW	30%		40%
Dublin/ME	27.5%		40%

Commercialisation Fund

Enterprise Ireland provides funding for industry oriented research and expert support to help in the company start up process or seeking to licence the new company's technology to industry partners.

Patent Fund and Advice

Enterprise Ireland can help with patent costs and supply advice on all aspects of the patent process.

Technology Road-Mapping

Enterprise Ireland organises events where industry experts from global companies share their views on the latest developments and future opportunities in their fields. These events also provide opportunities to meet potential business and research partners.

EI Commercialisation Fund - Technology Development

Technology Development phase of the Commercialisation Fund - funds research aimed at major technology development around platform technologies or groups of products built around a new technology. To gain support the proposing company must be able to demonstrate that the underlying technologies are sound and there is an identifiable market. The fund supports research in areas of technology of medium term interest to industry in Ireland leading to technologies, products or processes that can provide the basis of new businesses in Ireland or can improve the competitiveness of industry in Ireland through licensing agreements.

The Technology Development grants are subject to the terms of a grant agreement between the host institution and Enterprise Ireland. They cover 100% of all eligible costs (e.g. personnel, equipment, material and travel) and should typically be for no more than €350,000 - €400,000 for projects typically up to three years duration. Priority is given to projects leading to technologies that may be of commercial interest to existing industries in Ireland and are transferable by means of licence or other practical arrangement or have the potential to provide the basis of new business areas.

The areas covered are life sciences/biotechnology, informatics and industrial technologies, but once again there is no mention of the Built Environment.

Innovation Partnership Initiative

Enterprise Ireland also supports the development of R&D partnerships between third level institutions and industry and works with groups of companies to build longer term collaborative R&D programmes which involve third level institutions. It has supported collaboration at a regional level between experts located in the regional Institutes of technology and locally based companies.

Intellectual Property Advice

Enterprise Ireland provides intellectual property advice on the protection, development and commercialisation of patentable technology. In certain cases it provides financial assistance with the cost of patenting. The service also covers the use of intellectual property rights (patents, copyright, designs and trademarks); confidentiality agreements; licensing (negotiations, royalty rates etc). Much of this information is accessible online: Intellectual Property Patenting and Exploiting an Invention in MS Word (144kb) Intellectual Property Assistance Scheme Brochure in MS Word (121kb). Intellectual Property Assistance Application Form in MS Word (101kb), Higher Education Sector Patent Protection Scheme; Strengthening Technology Transfer Offices.

Incubator programme

EI's incubator programme offers space and support to entrepreneurs throughout Ireland to develop their projects within the supportive structure of a college campus.

Technology Transfer TechSearch

The TechSearch service helps companies to find and licence-in suitable products and technologies. By drawing on its extensive network both internationally and domestically, EI helps companies to access new technology; improve the competitiveness of existing production; move into new higher value areas. There is a strong emphasis on linking with and obtaining to thirty centres located within Irelands universities and institutes of technology. The emphasis as before is on informatics and biotechnology. Industrial technologies are not defined to include a civil engineering focus.

Enterprise Ireland Proof of Concept Scheme

This is the first scheme to overtly identify built environment research areas within the scope of the support on offer. The scheme is open to full time researchers in third level institutions seeking support that a scientific concept, from whatever source, is sufficiently robust to address a viable market and is not encumbered by intellectual property considerations. The scheme covers four areas: physics & electronics; informatics; chemistry engineering & materials; and life sciences. Proposals are reviewed by four specialist panels and only one proposal from any one applicant may be submitted at a given time. Applications however may be made throughout the year for subsequent evaluations. There is a turn around time of approximately 2 months between each deadline and the announcement of results from the National Research Support Fund Board. The scheme focuses on a "proof of concept" model. Individuals or small groups work on short applied projects to develop a product concept through to a stage where a route to commercialisation is clear, either as a campus company or through licensing. In this scheme grants to an indicative level of €90,000 may be awarded for a period typically of up to 12 months or exceptionally 18 months, subject to a competitive evaluation process. See General information and conditions </ResearchInnovate/docs/GeneralInfoCond04.doc>.

The Innovation Partnerships Initiative

The Innovation Partnerships Initiative provides financial support to encourage companies to undertake research projects with Irish universities and institutes of technology.

Framework programmes

Enterprise Ireland is actively involved with firms to secure participation in the EU Framework Programme for R&D, as well as the EUREKA and European Space Agency Programmes. This is the one initiative which gives equal access to Civil engineering teams.

Global R&D

Enterprise Ireland supports trade and technology transfer offices worldwide. One aim of the global offices is to develop relationships with global corporate leaders and through these links integrate companies into worldwide networks of firms, working together on collaborative research and exchange of ideas.

Client Teams

Support is offered under this scheme to researchers working in collaboration with commercial companies. Expertise appears to be restricted to biotechnology, industrial technologies and informatics.

Conclusion on the Irish case

As currently configured there appears to be little overt R&D focused support available in Ireland for companies operating in the Built Environment sector. These paragraphs have identified some of the historical reasons behind this: the relative absence of built environment expertise in the central decision and administrative reaches of the public life in Ireland; the lack of R&D awareness in the sector given sustained high levels of demand for existing product; coupled with the dominance of business manufacturing plant models as exemplars of excellence.

The challenge which Innova: Build Nova and its partner companies, academics and development agencies in Ireland now face is how best to draw on what R&D supports do exist within third level education institutions and extend this model in ways that can meet the needs of an increasingly R&D aware construction sector.

As part of this process there is a need to identify the emerging business models in this sector and to link the outcomes of this work to the development of dedicated programmes and support systems focused on the sector. The Innova: Build Nova initiative is the first step in such a paradigm shift.

2.3.6 Poland

There are no specific founds for construction sector in Poland. It is also quite difficult to see really innovation support organisations in construction sector although. ITB plays anyhow a role in the innovation process for instance through assessment procedures.

Table 57: construction-specific innovation support structure

Name of organisation	Building Research Institute
Web site	http://www.itb.pl/ang/index.htm
Objective	The basic aim of research and development works carried out in ITB is to ensure the quality of Polish building industry and to protect the interests of users of the construction works. Within the Building Research Institute, the Group of Testing Laboratories is operated, including 14 accredited in PCA laboratories, which conduct the specialised tests of building materials and products. For the needs of technical approvals and certification of products, laboratories carry out tests, which are the basis for marking the home-made products with the mark B and for affixing the CE marking for products in the EU area.
Financial resources	n/a
Contribution to innovation	Assessment methods development, support in scientific research within new products, possible supervision of new products development

Table 58: non construction-specific innovation support structure

Name of organisation	**Naczelna Organizacja Techniczna** **[Polish Federation of Engineering Associations]**
Web site	http://www.not.org.pl ; EN version http://www.not.org.pl/english/?s=d
Objective	Conferring Professional Titles, organizing events, training conference aim at development of professional skills of engineers;
Financial resources	Association distribute part of founds targeted to co-financing innovative products in SMEs [production sector]
Contribution to innovation	Training, distribution of founds, technological audits
Name of organisation	Polska Agencja Rozwoju Przedsiebiorczości [**Polish Agency for Enterprise Development]**
Web site	www.parp.gov.pl ; EN version http://www.parp.gov.pl/en/
Objective	**The Polish Agency for Enterprise Development (PAED)** is a governmental agency subordinate to the **Minister of the Economy**. Its task is the management of funds assigned from the State Budget and European Union for the support of entrepreneurship and the development of human resources, with particular consideration given to the needs of small and medium sized enterprises (SMEs). The objective of the Agency is the implementation of economy development programmes, in particular with respect to the support of: SME development, Export development, Regional development, Application of new techniques and technologies, Creation of new jobs, tackling unemployment and human resources development.
Financial 3resources	
Contribution to innovation	Distribution of founds for innovative products, Innovation Awards,
Name of organisation	Ministerstwo Educacji i Nauki [Ministry of Education and Science]
Web site	www.mnii.gov.pl; EN version available
Objective	Ministry finance all national state owned research and education institutions. It also is responsible for distribution of Structural Founds dedicated to
Financial resources	
Contribution to innovation	Distribution of Structural Founds target to cooperation between research institutes and enterprises.

2.3.7 Spain

Table 59: Construction-specific innovation support structure

Name of the organisation	Instituto de Ciencias de la Construcción Eduardo Torroja
Description	The IETcc forms part of the Consejo Superior de Investigaciones Científicas (CSIC) and is a centre of investigation an scientific-technical assistance in the field of construction.
Web site	www.ietcc.csic.es
Financial Resources	?
Contribution to innovation	The IETcc claims to work for the progress in construction: • Giving impuls to the innovation in construction systems and techniques, • Analysing the reliability of the structures and new materials, • Investigating to improve the comfort of buildings and minimize the energy consumption, • Investigating the durability of the materials, • Evaluating the causes of the pathologic processes in constructions, • Developing new materials and studying the recycling of demolition waste, thereby reducing the environmental impact.
Name of the organisation	CEDEX – Centro de Estudios y Experimentación de Obras Públicas
Description	The CEDEX forms part of the Ministry of Public Works, but works as well for the Ministry of Environment. It provides multi-disciplinary services for national, regional and local institutions as well as for private companies in the area of civil engineering. 70% of its resources are spent on high level technical assistance and the resting 30% is spent on applied research & development, transfer of technology and other activities regarding technical and scientific information.
Web site	www.cedex.es
Objectives	• Obtain, study and facilitate information of nature, • Improve the quality of materials, elements, techniques, methods and systems used and increase the knowledge on natural resources, • Contribute to the functionality, technological actualisation, security and adaptation to the environment and the spatial planning of the infrastructures and services, • Give impulse to, promote and realise scientific and technical investigation and technical innovation, • Give technical support with priority for the Ministries of Public Works and Environment and the entities and organisms that depend on them, • Promote and disseminate science and technology in national and international areas.
Financial Resources	?
Contribution to innovation	Singular testing laboratories, development of models and numerical simulations, cooperation with foreign institutes.

Table 59 (continued): Construction-specific innovation support structure

Name of the organisation	CIEMAT - Research Centre for Energy, Environment and Technology.
Description	Public Organism for Research and Technological Development The CIEMAT, an Organism of the Ministry of Education and Science, is a Public Research Agency for excellence in energy and environment, as well as in many vanguard technologies and in various areas of fundamental research. The mission of the Centro de Investigaciones Energéticas Medioambientales is to contribute to the sustainable development of the country and the quality of life of its citizens, through the generation and application of scientific and technological knowledge
Web site	www.ciemat.es
Objectives	• Promote and execute R&D activities according to the directives of the Ministry of Education and Science, in energy, environment and technology, including the associated sociotechnical focus, and in specific fields of Basic Research. • Be a centre of reference in the scope of its competence in cooperation with the regional governments. • Collaborate with other national R&D centres, universities and business. • Integrate activities in the framework of the European Union and cooperate with intergovernmental organisms and R&D centres in other countries with special attention to Latin America and the Mediterranean. • Foster activities derived from its R&D in the fields of scientific-technical diffusion, education and technology transfer. • Provide technical services in the areas within its scope of competence. • Advise governments and public and private institutions and represent Spain in international forums where applicable.
Financial Resources	?
Contribution to innovation	To favour the process of technology transfer, the CIEMAT is making a considerable effort to synthesise and make available to the production system, such knowledge and capabilities as may have been developed in the course of its research projects. For this, it signs conventions and collaboration agreements and contracts with companies, and takes out patents, generates products and technologies applicable to society and industry, and publicises them in training courses on matters which are the subject of research and technology development at the Centre.

Public funding programmes

Public funds for R&D can come from different sources in Spain [COTEC, 2005]:

1. National funds via the National R&D Plan (Plan Nacional de I+D),
    a. Function 46,
    b. Structural funds of the EU,
2. Regional funds.

Plan Nacional de I+D

The 'Plan Nacional de I+D' has 5 different forms of participation through which organisations can have access to funding:

1. R&D Projects,
2. Special actions,
3. Reinforcement of human resources (some co-financed by Social Funds of EU),
4. Scientific and/or technologic equipment (in majority EU funds),
5. Support to technical innovation and the transfer and dissemination of results.

Table 60: Private support structure specific to the construction sector

Name of the organisation	**AIDICO – Instituto Tecnológico de la Construcción**
Description	AIDICO is an institute formed by companies of the sector. It is final objective is to increment the innovation and quality capacity of the companies to strengthen their competitiveness in national and international markets.
Web site	www.aidico.es
Objectives	The objectives of AIDICO are: • Technical support to SMEs of the sector, • The introduction of advanced technologies, • The execution of projects in cooperation with the companies, • The analysis and testing of materials, • The information on technology and norms of general interest, • The organisation of courses and seminars.
Financial Resources	?
Contribution to innovation	AIDICO works in: • R&D • Characterisation of construction materials, • Calibration of measurement and testing equipment, • Certification of products and systems, • Informatics and automatics, • Office of Transfers and Results (OTRI), • Information and documentation, • Education, • Publicity and marketing, • Virtual architecture.
Name of the organisation	**CIDEMCO – Technological Research Centre**
Description	CIDEMCO Technological Research Centre, is a private, not for profit organization which actively contributes to economic and social development, supporting and promoting Technological Innovation and Development (R+D) processes such as competitiveness strategies for environmental business. Basically, it is a Private Technological Services Centre, within the reach of all types of companies (size, location, etc.) and sectors of productive activity. Located in Azpeitia (Gipuzkoa), it was created in 1989 by public companies and institutions in order that industry and building would have proper technological support
Web site	www.cidemco.es
Objectives	Give technological support in the different areas: • Materials • Biotek - Wood • Building • Furniture • Production - Engineering • Mechatronics
Financial Resources	?
Contribution to innovation	In CIDEMCO are carrying out projects of R+D+i to achieve the aims of their clients, contributing with their experience and knowledge of their personnel, the equipments most advanced and always with confidentiality.

Table 60 (continued): Private support structure specific to the construction sector

Name of the organisation	**INTROMAC – Instituto Tecnologico de Rocas Ornamentales y Materiales de Construcción**
Description	El Instituto Tecnológico de Rocas Ornamentales y Materiales de Construcción (INTROMAC) has as basic action lines the following ones: • Research, Technological Development and Innovation. • Services of Added Value in the Industrial Sector. • Laboratory of tests. • Training, Information and Advice. • Promotion and Sectorial Marketing
Web site	www.intromac.com
Objectives	• To get to know itself as Technological Centre in all the areas of interest, taking part in networks, forums and systems of information transmission of the research area. • To foster the participation of all the agents involved in the sectors of the ornamental rock and the construction in activities of R+D+i, developing the role of organisation interface. • To give access to Training of those agents of the sectors objective which need it, as a way for the attainment of the development. • To favour the adjustment of the products and services to the increasing normative and market requirements, through of the quality promotion. • To make compatible the structure of non profit Technological Centre with the effective and efficient company, which looks for the customer satisfaction
Financial Resources	?
Contribution to innovation	To put at disposition of the companies its resources, and its contacts with other institutions in order that the activities of research and innovation are possible
Name of the organisation	**ITeC – The Foundation Catalonia Insitute of Construction Technology**
Description	The Foundation Catalonia Insitute of Construction Technology - ITeC, is an independent non-profit-making organisation that carries out its work in the area of operations intended to further the progress of construction
Web site	www.itec.es
Objectives	
Financial Resources	?
Contribution to innovation	To put at disposition of the companies its resources, and its contacts with other institutions in order that the activities of research and innovation are possible

Table 60 (continued): Private support structure specific to the construction sector

Name of the organisation	**LABEIN – Technology Centre**
Description	LABEIN Tecnalia was created in 1955 as a Technology Centre focusing on business, with a mission to become a natural ally of business to develop its innovative capacity using technology as a tool of competitiveness. This means understanding and sharing business strategies and joining key company activities, contributing differential knowledge and added value. We do not now merely offer our skills to customers, but also act as a knowledge network node to add greater value than individual isolated activities. To this end, LABEIN Tecnalia promotes and carries through technology and market alliances and projects at national and international level with other centres and companies with proven leadership capacity, and takes part in excellence networks in strategic areas
Web site	www.labein.es
Objectives	In order to develop a sustainable society, this hypersector must take responsibility for the party it plays, since it consumes 40% of materials resources, generates 35% of greenhouse gases, and creation and operation of the facilities built account for at least 50% of total energy consumption. Thus the sector must find strategies to improve the efficiency and sustainability of the products and processes in relation to the design, construction, operation and maintenance of structures, reducing the impact on the environment and administering the land used. The sector also faces other challenges such as rehabilitation and regeneration of a large number of urban and interurban areas, improved competitiveness, reduction of life cycle costs and increased returns on investment. It must make its contribution to social integration by building more sustainable buildings and cities, and maintaining a balance between respect for local identities and multi-cultural awareness by retaining cultural heritage. It must also produce new materials which are constantly changing with today's increasing performance demands and building systems and processes must evolve towards greater efficiency, safety and employment quality.
Financial Resources	?
Contribution to innovation	To put at disposition of the companies its resources, and its contacts with other institutions in order that the activities of research and innovation are possible. The future of the sector depends on innovation through encouragement of R+D+R, and it must focus on becoming a hi-tech sector dealing with criteria in relation to competitiveness, respect for the environment, safety and full social acceptance
Name of the organisation	**ICCL – Instituto de la Construcción de Castilla y León**
Description	The Institute of the Construction of Castilla y León, I.C.C.L., it is constituted as non profit private Foundation of scientific - cultural character, which wants to affect in all the technical aspects that intervene in the construction process of a building site, already be Civil, of Building or of Rehabilitation
Web site	www.iccl.es
Objectives	• Technical forum that put together all the social agents of the construction of Castilla y León. • Technical and scientific support to professionals and businessmen of the construction. • Promotion of the INTEGRAL QUALITY in the whole constructive process. • Promotion of the normalization and regulation of the sector. • Technological Centre to stimulate the Technological Innovation.
Financial Resources	?
Contribution to innovation	To put at disposition of the companies its resources, and its contacts with other institutions in order that the activities of research and innovation are possible. To contribute advice and technological support to the companies of the sector, introducing new systems of information and lines of innovation that make them more competitive on the market

Table 60 (continued): Private support structure specific to the construction sector

Other organisations

Organisation	Web Site
Centro Tecnológico Andaluz de la Piedra	www.ctap.es
CTCON (Centro Tecnológico de la Construcción Región de Murcia)	www.ctcon-rm.com
Centro Tecnológico del Marmol	www.ctmarmol.es
Instituto de Tecnología Cerámica	www.itc.uji.es

Table 61: Private support structure non specific to the construction sector

Name of the organisation	AIMPLAS, Technological Institute of Plastics
Description	The field of activity of AIMPLAS falls within research applicable to the plastic transformation sector, to support, technological development and innovation through integral solutions that can be adapted to the enterprises.
Web site	www.aimplas.es
Objectives	
Financial Resources	?
Contribution to innovation	AIMPLAS offers: • analysis and testing, • processing, • quality and environment management.
Name of the organisation	**AITEMIN - The Association for the Research and Industrial Development of Natural Resources.**
Description	Founded in 1976 as a private association in the form of an independent, non-profit organization for the purpose of carrying our research, development, demonstration and dissemination activities for the exploitation, management and assessment of natural resources, including other preparatory, concurrent and related activities. Activities: • Sectors and tecnological áreas • Research and development • Technical services • Training • Spreading and publications • Available products and patents • Search by key words
Web site	www.aitemin.es
Objectives	AITEMIN carries out its activities under contract in all cases, said activities including both applied research as well as providing technological services for industry, for government agencies and for other public and private organizations
Financial Resources	?
Contribution to innovation	AITEMIN is recognized and registered as an Innovation and Technology Centre. As such, AITEMIN focuses its endeavours totally on industry and on serving companies

Table 61 (continued): Private support structure non specific to the construction sector

Name of the organisation	**CARTIF – Parque Tecnológico de Castilla y León**
Description	The Fundación CARTIF was founded in Valladolid in October 1994. CARTIF is a non-profit-making Applied Research and Technological Innovation Association which forms part of the Castillo y León network of Technological Centres. It also belongs to the networks of Technology and Innovation Centres (CIT) and to OTRI (Offices for the Transfer of Technology) of the CICYT.
Web site	www.cartif.es
Objectives	Its main goal is the development and application of technologies and procedures which help to improve the competitiveness of the companies with which it cooperates. Since its foundation, it has gained great experience in the field of applied research and the development of industrial solutions through a large number of contracts with various companies
Financial Resources	?
Contribution to innovation	• Internal R&D as a means to improve the Centre in technological areas of particular importance for Castillo y León, which will eventually also be at the disposal of the business sector of the region. • The continuous support and creation of small companies which will eventually become fully-fledged and will not have to depend on CARTIF. This type of company, known as spin-offs, will have to focus on the innovation of both their products and processes. There will be incentives for the creation of these companies for the research staff of CARTIF. • To promote participation in international projects, which is essential for the future development and consolidation of the Centre

Table 61 (continued): Private support structure non specific to the construction sector

Other Organisations

Organisation	**Web Site**
Fundación del Patrimonio de Castilla y León	www.fundacionpatrimoniocyl.es
Instituto de Biomecánica de Valencia	www.ibv.org
Instituto Tecnológico de Castilla-León	www.iccl.es
Universidad Carlos III Madrid	roboticslab.uc3m.es
Universidad del País Vasco	www.ehu.es
Universidad de Cantabria	www.unican.es
Universidad Politécnica de Cataluña	www.upc.es
Universidad Politécnica de Madrid	www.upm.es
Universidad de Valencia	www.uv.es
Universidad de Valladolid	www.uva.es

Synthesis on the chapter “funding programmes”

In the analysed countries, several public financing and expert structures are targeted on research and technological development. But differences among countries remain:

- In Finland most public organisations are not specific for the construction sector – but specific programmes concern the sector.

  For example, The Finnish Funding Agency for Technology and innovation (TEKES) defines its technology programs in areas that are important for business and society. Some of these programmes allow the development of technology and innovative concepts direct or indirect to the construction sector. In 2004 Start-up loans for new technology companies were 2.2 million euros. Also 55 percent of the funding for business R&D was directed towards SMEs and 77 percent towards companies with less than 500 employees. Total 237 million euros and 1 464 projects. This has particular relevance to the construction sector due to the high number of small companies.

  Private interest groups organised around contractors, real estate owners…also support applied research projects.

- In Belgium and France, some public support structures are specific to construction. Most of them focus on applied research. Other structures which are not specific, support innovation by providing firms with funds (DGTRE in Belgium, OSEO ANVAR in France) and the diffusion of scientific results to the industry (IWT in Belgium, ANRT in France).

- In every country :
  - There are some public institutions which aim at providing the industry with assessment methods (BBRI in Belgium, VTT in Finland, CSTB in France, ITB in Poland and IETcc in Spain).
  - Most of public programmes support SMEs.
  - Energy and environmental issues are main issues for the construction sector to be integrated in technology programmes.

3 Strengths and weaknesses of the construction sector

The strengths and weaknesses (S&W) of the construction sector have been presented in many national reports. The situation presents common aspects in all partners' countries.

Several elements are necessary to draw a clear picture of the strengths and weaknesses of the construction sector:

- Technical aspects: predominance of construction techniques differ from one country to another
- Safety aspects: safety on site is a major issue
- Organisational aspects: procurement system, construction team, role of regulation, solution driven…
- Cultural aspects: oral transmission, weight of tradition…
- Financial aspects.

These five topics are developed from information provided by BUILD NOVA partners with a specific emphasis on the Finish case which is well documented.

3.1 COMMON ASPECTS AMONG COUNTRIES

Table 62: S&W – technical aspects

Technical aspects (predominant techniques differ from one country to another, danger of work on site …)	
Strengths	**Weaknesses**
• The combination of industrialisation, efficiencies in the construction process and in the performance of construction materials has brought important improvements during the last century. • The main projects are carried out thanks to the high technological level of a central core of companies. • Regulation stimulates innovations (e.g. more stringent standards of energy efficiency, safety at work).	• Higher percentage of labour accidents due to the lack of a safety culture among the workers (mainly the old generation?). • Rules, regulations may hinder the incorporation of novelties. • Imbalance between the technological offer of technological centres and the needs of the company. • The current construction technologies are based on on-site erection and the assembly of elements that in general require heavy equipment. Both processes often require important quantities of temporary structures. This result in general in lower productivity and quality of the building and increased risks for the workforce on-site.

Table 63: S&W – sector organisation

Sector organisation (procurement system, construction team, role of regulation, solution driven)	
Strengths	**Weaknesses**
• Proximity of clients • Strong sectorial associations • Decentralisation of responsibilities and operatives centres to take decisions lead to good reactivity • Flexibility of the organisation.	• Highly fragmented sector, SMEs represents more than 95% • Lack of communication among stakeholders • Complex regulation (legislation) • Many subcontracting processes resulting in a worrying lack of project control • Oral communication is not a good support for quality management control process • No researchers in the managerial sector • Complexity of inter-company relations with a unique production chain, consisting of major contractors, supplying industries, subcontractors (specialized or not), and self-employed workers • The construction sector is sensitive to social dumping and unfair competition • Predominance of prices as criteria to award projects, specially from the Public Administration

Table 64: S&W – innovation culture

Innovation culture (oral transmission, weight of tradition)	
Strengths	**Weaknesses**
• Beginning of a managerial cultural based on innovation • Actions carried out by the sector to promote the relationships among companies, technological centres, transference technology offices and Universities	• High weigh of tradition, especially in building sector. Small changes in home construction. It is still very much dependant on manual labour processes. • R&D activities are not always considered as a future investment but as an expense. • Scanty knowledge and lack of valuation on the companies about services of Transference Technology offices,… • Companies only invest in R&D if they are going to obtain benefit in the short or medium term. • Lack of awareness on the need to innovate and the means for creating a culture in which innovation can thrive. • Current construction technologies are resources based instead of knowledge based. In general the knowledge available within company is hardly shared and new technologies hardly find their way to the construction site. • Human science principles are hardly present in current construction technologies, where end-user participation in the design and feedback from these end-users are practically non-existing.

Table 65: S&W – financial aspects

Financial aspects	
Strengths	**Weaknesses**
• Gradual increase of the public funds for the promotion of the R&D • Active role of the Government in the recovery (revival) process of the Lisbon strategy (initiated by UE in March 2005) with specific actions in relation to the approximation to managerial promotion, competitiveness promotion…	• Excess of bureaucracy to obtain public helps for R&D/innovation projects • Scanty dedication of financial resources from the companies to the innovation. The managerial funding is far from the Lisbon objectives • Low consideration of the businessmen towards research, technological development and innovation as an essential element for competitiveness.

3.2 STRENGTHS AND WEAKNESSES OF THE FINNISH BUILDING AND CONSTRUCTION SECTOR

The case of Finland shows that some strengths and weaknesses are specific to the national building and construction system.

Table 66: S&W – Finnish case- technical aspects

Technical aspects (predominance of techniques different according to countries, danger of work on site…)	
Strengths	**Weaknesses**
• Standards and technical procedures are well document and actors in the construction chain do follow them. • Safety regulations are good and followed on site. • Environmental protection through the building life-time is already an issue for the Finnish Construction sector – here Finland has a clear advantage in the use of wooden products and in the advance research on this area. • State of the art, or in fact beyond state of the art tools. When tools are required, they are developed in-house when no commercial solutions are available. • To allow for better project planning and control, often 2-D drawings are converted in to building product model by the contractor	• Difficulties in solving problems or accept new solutions which fall out the documented procedures. • Problems at times when working with foreign companies, as the work procedures in Finland are highly systematic with state of the art ICT tools (lacking in most countries) • Though working safety regulations are followed quite careful the number of accidents is still high when compared with other Nordic countries.

Table 67: S&W – Finnish case- sector organisation

Sector organisation (procurement system, construction team, role of regulation, solution driven)	
Strengths	**weaknesses**
• Finland has tradition in associations which helps networking and dissemination with all the partners (small and big) in all branches of the construction chain. • Finland has tradition involving public and semi-public organizations on private-public partnerships • There is a general acceptance and trust in e-commerce. 2001. IT barometer indicates Finland to be the Nordic country with the greatest use of e-commerce in the construction sector. • Being a small country, people and organisations know one another. This helps in collaborative work. • Level of trusts are high (Finnish culture)	• Not always enough competition. • In an international scale Finnish companies are small and can only be competitive working together – at this scale need to increase collaboration and data interchange to compete as a "big one". • Sector specialised personnel is ageing. There is a need of highly skilled engineers with ICT competences to handle on-site work. • Reluctance of fresh graduates to work on construction sites.

Table 68: S&W – Finnish case- innovation culture

Innovation culture (oral transmission, weight of tradition)	
Strengths	**weaknesses**
• Finnish construction sector is well in advance in the integration of IT tools in their processes. This implies competitive advantages in: o participation in further R&D projects and integration of innovation as the culture already exists. o international competition as knowledge exporters • Innovation is driven both by organisations and public funding bodies. Partial public funding is available to research a specific technology, after this, industry associations and clusters take over for further research, development, implementation, and shared deployment.	• There is too much offer – need to help companies in selecting • Not enough interest in basic-research – future know-how might be compromised • While not necessarily a weakness per se, Finnish innovation is often restricted by the limited innovation and research potential of organisations in other countries. (E.g. when a new data exchange standard is available, it can take several years before others start using it).

Table 68 (continued): S&W – Finnish case- innovation culture

Benefits from Finnish society environment: • Finnish market offers high-flows of IT solution and have several and good companies operating in the business. This makes it easy for the Finnish construction industries to find partners to develop for them innovative solutions • SMEs are a concern in the Finnish innovation policy – government agencies coordinate the support for innovation in SMEs as referred above for TEKES. • Good mechanisms are in place to link different phases of the innovation process: customers requirements are translate into technology programmes, R&D results are disseminate and support for industrialisation and commercial development is created – open communication channels are created.	•

Table 69: S&W – Finnish case- financial aspects

Financial aspects	
Strengths	**Weaknesses**
• Innovation is driven both by organisations and public funding bodies. Partial public funding is available to research a specific technology, after this, industry associations and clusters take over for further research, development, implementation, and shared deployment. • Finnish organisations large and small understand that the key to sustainability and growth is continuous innovation. Finances for innovation activities are therefore sanctioned for both organisations and the public sector. • If there is an innovative idea that can have significant market potential, then there are usually available funding sources.	• Not necessarily a weakness, but project plans on whose basis funding decisions are made are limited in detail. So while there is at times not enough detail upon which to make a decision, this allows for more innovation proposals, and limits the time that is lost in preparing applications (project proposals).

3.3 THE FINANCIAL ISSUE: THE CASE OF 50 NEWLY CREATED ENTERPRISES

The French weekly construction magazine “Le Moniteur” published during the last three years cases of newly created construction companies.

Available information concern the business sector, the capital structure, the year of creation, the number of employees and the background of the founder(s) (usually the manager(s) and owner(s)) of the firm. All companies were less than 5 years old.

CSTB focuses on the financial issue and examines the capital structure of 50 companies. The aim was to study how financial problems could hinder the development of a start-up. Table 70 presents the results.

This survey which is based on a sample of company which are not statistically representative of the sector provides after all interesting elements:

Table 70: panel of innovative companies

	Number of employees			**Patents**		**Public subsidies**		**Support of an investment fund**		**Support of a large company**	
Activity	<10	10-19	20-25	Yes	No	Yes	No	Yes	No	Yes	No
Construction techniques	3	1	0	3	1	1	3	0	4	0	4
Contractor (site process)	8	0	2	0	10	1	9	0	10	0	10
Manufacturer	4	2	0	2	4	1	5	2	4	2	4
Consultant	5	2	0	0	7	1	6	0	7	1	6
ICT	10	2	0	1	11	4	8	2	10	2	10
Civil engineering	10	1	0	4	7	4	7	1	10	3	8
Total	**40**	**8**	**2**	**10**	**40**	**12**	**38**	**5**	**45**	**8**	**42**

The table indicates that:

- All companies are less than 5 years old and are very small (80% with less than 10 employees),
- Newly created companies have access to diversified sources of financing,
- 24% of the firms have received some kinds of public subsidies (e.g. financial aids, free rent),
- Investment funds are involved in 10% of the projects,
- Large companies support 16% of the new firms (e.g. as a client or as an investor),
- External funds dominate ICT and civil engineering projects,
- The lack of financial funds does not appear to be a problem in most cases. However one firm mentioned that the development of its project would have been faster with appropriate financial supports,
- Venture capital seems not adapted to traditional innovations developed by the building and construction industry. But it seems more appropriate to innovations connected to ICT and dedicated to the building and construction industry.

4 Conclusion: From strengths and weaknesses to business forums

This description of the innovation framework and the presentation of the strengths and weaknesses of the sector indicate that the difficulties encountered by the actors may vary according to their place within the production chain and the local business environment.

Concerning the financing issue, the analysis tends to indicate that:

- Most innovations developed by contractors are ad hoc responses to problems encountered in the course of a construction project. In these cases financing is rarely an issue, except for instance when the site innovation is turned to be a product or process innovation to be proposed on the market
- Manufacturers require more funding to finance innovation (particularly at the commercial stage).
- Newly created companies (even VSMEs) have access to diversified sources of financing.
- Examples of financing through venture capital were not identified. A hypothesis is that this kind of financing is not adapted to traditional innovations developed by the building and construction industry. Examples may be found in IT innovation project for building and construction applications.

The aim of the BUIL-NOVA project "***helping technology firms (both high-tech and less technology intensive companies) to find suitable funding*** *for their new innovative projects".* To reach this goal, it is necessary to understand the nature and characteristics of the innovation process for the different actors of the building and construction industry.

Table 71 next page provides this information by summarising some of the results presented in the previous parts of this report. This could be used as a starting point for the next steps of the project:

1. The elaboration and/or adaptation of materials and tools adapted to the requirements of the sector.
2. The organisation of business forum.

Table 71: Innovation in the building and construction industry

Category	Relative size	Nature of innovation	Innovation drivers	Financing
Contractors	Wide range from large groups with decentralised affiliates to independent SMEs Specialized trades (plumber, electrician, mason …), which, in most cases, employ less than 10 employees.	Mainly process and methods. One of a kind and short term problem solving innovations. In some cases, these innovations may be further developed. Incremental innovation is overwhelming. Big contractors also develop service innovation.	Clients driven. Regulation. Safety and productivity. Low level of R&D. Know-how of the employees working on the building site is crucial. Manager often plays a key role in the innovation process (especially in (V)SMEs).	Most innovations do not require huge sum of money because it is a problem solving approach. When innovations are turned to commercial products, processes or services, funding might become an issue.
Products manufacturer	Some international groups but a domination of small and medium sized firms. Some of them lead their national market but their international market share is limited	Mainly products and processes. Incremental innovations dominate with some examples of radical innovations. Services innovation are complementary and a success factor to differentiate from competitors.	Clients driven. Regulation. Productivity. Rivalry among firms. More or less developed in-house R&D structures according to firm size (expertise and know-how of the manager for small firms).	Need for funds can be high when the firm carries out its own R&D. Commercial stages always require to find suitable funding.
Products distributor	Generally local activity (close to local contractors). May be subsidiaries of bid manufacturers.	Services innovation. Also products innovation in order to better fit with clients demands.	Clients driven. Regulation. Rivalry among firms...	
Material suppliers	Large international groups in a limited number of domains (steel, glass, …)	Mainly products and processes. Radical innovation is relatively more important than for other categories of firms.	Scientific progress. Regulation. Rivalry among firms. In-house R&D laboratory,	Groups are quoted on the stock exchange. They have access to international funding and received most public subsidies.
Services providers	Large and small firms. Competition may be national (housing companies) or international (real estate investors, facilities managers)	Mainly service and organisational innovation. Incremental innovation dominates.	In-house project groups, marketing and after-sales departments, customer-relationship management, top-management, co-production with the clients, regulations, imitation of competitors	

PART B: TECHNOLOGY AND MARKET TENDENCIES

EXECUTIVE SUMMARY

A building is made of both mass-manufactured products such as concrete blocks, clay tiles or copper tubes and of tailored products such as window frames or structural elements.

A building is also a system so that the identification of technology and market tendencies requires considering both the individual products and the global system made from these products.

The driving factors for innovations are so to be found:

- in the search of contractors for productivity and competitiveness improvement,
- in progresses outside the construction sector (materials improvements, ICT tools, …)
- in social demand pushing for more environment-friendly, safer or cheaper services and products,
- in political decisions concerning for instance the reduction of energy consumption or of green-house gas emissions,
- in professional decisions to improve work conditions and safety on sites,

Mapping the technology and market tendencies is then very challenging.

This part of the report intends to address this question by analysing information collected from BUILD-NOVA partners using a specific framework.

This framework targets the actors chosen in part A of the report (contractors, manufacturers and products distributors) adding the service providers, as service innovation is intended to experience important developments.

For each of these actors, experts were asked to indicate technology and market tendencies as well as drivers and examples.

The analysis confirms the importance of energy-related tendencies with both products innovation (insulating materials, structural materials, windows …) and “system” innovation such as the development of highly energy efficient buildings.

The orientation to think building as a system is probably favourable to push for innovation but it requires separate actors to join in order to create adequate and marketable offers.

1 Introduction

Buildings meet one of the most fundamental needs of humanity: provide a shelter to protect human beings from any kind of aggression (climatic, seismic, explosion, intrusion …). This activity is rooted in ancestral tradition and many contemporary technologies are still derived from traditional know-how: masonry, roofing, window framing, floor tiling …

This does not mean that modern buildings are alike previously built ones. Significant innovations were introduced and are still being introduced by all the concerned actors of the construction sector.

The drivers for these innovations are for instance:

- the productivity improvement at different stages of the whole construction process from the procurement procedure to the site organisation through a better transmission of information (for example: ICT tools for design, for logistics organisation, for commercial relationships between actors, for work progress control …), including service innovation for the exploitation and maintenance of buildings,
- the improvement of safety work conditions on sites and in construction products manufactures,
- the development of new materials such as artificial cement (VICAT, 1815), reinforced concrete (LAMBOT, 1848), prestressed concrete (FREYSINNET, 1928), float glass (PILKINTON, 1958), …
- the introduction of regulation concerning public health (ventilation of dwelling introduced in 1930), thermal performances (the first French regulation was introduced in 1974 after the first oil shock), mechanical performances (dampers for seism impact attenuation, carbon fibre to reinforce concrete structures …) …
- the growing concern of the society as regard to environmental or climatic change issues (high performance buildings, over-insulated building-envelopes, high efficiency equipments …).

Technology and market tendencies are then driven by both permanent factors (productivity, profit) as well as by emerging contexts (environment, energy concern, social demand …).

2 From innovation to market

The promoters of these innovations are not always the same. For instance, contractors will very often be the initiators of site innovations driven by productivity or safety concerns whilst manufacturers will naturally be at the origin of products innovations that meet their customers' demands.

Distributors will be keen at initiating innovations concerning site logistics or e-commercial platforms. Facility-managers companies may also be the promoters of innovative service (financial, technical) to exploit and maintain buildings.

These innovations are rarely developed by the main initiator alone. As in any other sector of activity, there is a need for partners. Partnerships will depend on the innovation.

IT specialists will for instance be privileged for innovations requiring information processing: CAD systems for building design or site organisation, data bases for commercial exchanges, complex information systems for projects aiming at integrating construction process upstream and downstream actions.

Engineering companies will for instance be partners for the development of an innovative construction process.

Examples are infinite and there is a strong need for the clients to have indicators in order to appreciate the performances of these innovations. The interest for such indicators is a key issue for the building sector as constructions last many decades and early decisions impact the whole life cycle of the building.

The most developed tool that provides such information is the assessment procedure. Such procedures provide clients, as well as insurers, with useful information to select, implement and maintain innovative products, processes or services.

A further step in the information of the clients consists in certification actions that guarantee some precisely referenced characteristics of the innovation.

Several of the BUILD NOVA partners have a significant part of their activity in the assessment and certification field (BBRI, CSTB, LABEIN, VTT) and national bodies do act in this domain in other countries.

This short description shows how complex the construction innovation is and draws out the way from innovation to market.

3 Technology and market tendencies mapping

The aim of the task 2.1 of WP2 is the "*gathering of prospective analysis undertaken throughout Europe and interpretation and revision by a group of experts. The ultimate goal is to identify technological tendencies in the construction sector that may serve as guide-points for the innovation players and firms, in order to adapt new inventions to those tendencies. The result of this task will be those identified technology and market tendencies, complementary to the previous analysis and conclusions.*"

To reach this goal, a framework was proposed to BUILD NOVA partners (table 1) but other sources were used such as existing literature on the subject.

Not surprisingly, these documents show a great variety of suggested innovation tendencies. This just reflects the profusion of innovation previously underlined in this chapter.

Table 1: framework for the collect of tendencies

Actor	Technology and market tendencies	Driver(s)	Examples
Contractors			
Manufacturer			
Product distributors			
Service providers			

A way to organise this information is to sort key words that appear in the analysed documents. Table 2 shows the result of such an analysis carried out on the frameworks provided by BUILD NOVA partners (refer to annex). We do not pretend to do any statistical analysis but this exercise shows which terms and expression do appear more frequently. Rank A key words are the most frequent.

Different document would probably emphasize other expressions that are likely to be among rank B key words also found in the analysed documents.

Table 2: categories of key words

Rank A		Rank B
Key word	**Related expressions**	**Key word**
Design	Total-lifecycle design Integrated design Flexible design User-oriented design	Life cycle Sensor Prefab Sustainable Waste Delivery Regulation Automation Wireless Simulation Smart Risk Resource Insulation Indicator Assembly Eco-friendly Nano-technology e-commerce Accessibility Remote Solar Ventilation Label Industrialisation Rehabilitation Recycling Certificat(-e, -ion)
Environment	Indoor environment Environmental scenarios/impacts Environment protection Environment concern Urban environment	
Energy	Energy efficiency/performance Renewable energy Energy savings	
Maintenance	Integration of maintenance Sensors for maintenance Low maintenance structures Maintenance design	
IT or ICT tools	IT tools to control site machines IT tools to predict site activity ICT tools interoperation	
Services	Maintenance/repair services Validation of service performance	
Safety	Site safety e-learning Safety requirement	
Security	Security at work Data security Security access systems	
Durability	Material durability	
Integration	Integration of maintenance services	

Anyhow, main topics also come out of other studies. For instance the analysis provided by LABEIN underlines the following seven mega-trends, which confirm the previously identified driving factors:

- Sustainability, orientated towards a technological and industrial development of the construction sector that it does not suppose a "mortgage" for the future.
- Security of Use and Maintenance, understood as the extension of the safety that is applied in any design of engineering to other situations that could happen during the life of the structure.
- People that includes aspects relative to the safety and health of the persons, their formation and training.
- Materials, orientated to the development and improvement of the materials as technological tools for the construction sector.
- Process improvement, which includes aspects related to the integration of the chain of value, industrialization of processes, reduction of total costs and orientation towards the final users.
- Machinery related to machinery necessary for the execution of the construction works, which integrates sophisticated control systems, automation and safety where take part sensors, electronics and computer science.
- Information and Communication Technologies (ICTs), as support tools that facilitate the advance and modernization of the rest of technologies, besides helping to the development of communication infrastructures and exchange of the experience and knowledge accumulated.

A further interest of this study is to quantify the importance of these topics. Sustainability is ranked first while ICT is ranked last. This result reflects the sensitivity of the professional panel and, as far as ICT are concerned, the fact that these technologies are considered as a tool and not as an end by itself.

Another indication of sensitivity is given in the same report. Three groups (Companies, Administration, Technical Services and Research) expressed their interest for the first ranked mega-trends.

Sustainability concern appeared to be shared by all three groups, while the interest for other subjects is different according to the groups (table 3).

Table 3: interest of groups for mega-trends (source: Labein).

Group / Trend	Companies	Administration	Technical Services and Research
Sustainability			
Security of use and maintenance			
People			
Materials			
Process improvement			

Another example is given by the European Construction Technology Platform (ECTP, www.ectp.org) 2005 prospective report which presents a vision for a sustainable and competitive construction sector by 2030.

This report emphasises the importance of the construction sector and acknowledges the strength of the coming challenges related to environment and sustainability issues. It mainly targets the construction companies and confirms some of the already mentioned tendencies related to:

- site productivity through a global management including lean construction, 4D modelling, constructability,
- safety and health on site,
- Sustainability through a holistic approach of the construction life-cycle.

The report concludes that time is needed to implement such evolutions. Some visions are proposed: sustainable building, silent building, health cocooning, and “living building” where biological processes are controlled in order to ensure functions such as insulation, lighting …

The production activity may also change to some of the proposed visions: automated production site, flexible construction, virtual site and building …

Prospective studies are rather abundant and may contain part of our future. The question is to sort out all these proposals in order to support the most suitable ones according to political choices.

4 Conclusion

The main drivers for innovation in the construction sector were, have been and will go on being the improvement of productivity, of safety on site, of building quality.

This permanent evolution has been supported by progresses mainly made separately by all the actors.

Some radical innovations were introduced during the last decades. A famous example is the plaster board introduced in Europe after World War II. A more recent example is the self cleaning glass. These innovations are proposed by manufacturers and require huge amount of development and investments.

Many incremental innovations are developed on a daily basis by contractors. They are difficult to identify as they mainly concern one site. It would anyhow be worth to have these innovations known by the rest of the professionals. They very often are answers to repetitive problems. The resources needed to develop these innovations are generally much less than for the previous examples except when one of these innovations tend to be marketed out of the innovative contractor company.

This situation will remain for long but a new context may bring a new deal.

The requirement for much more environment-friendly buildings, for much more energy efficient contractions, for more natural hazard resilient urban areas will obviously lead to more coordinated innovations. A building is a system and not a collection of manufactured products.

This radical change may boost innovation not only on products but also on processes and on services needed to ensure the indispensable coordination. This may raise the interest of investors.

This does not exclude that radical innovation come from a third party actor …

ANNEX

Collected data on innovation and market tendencies

Finland (nota: this format is a variation of the format of table 1)

Category		Main areas of interest developed/planned on projects in Finland
Contractors	93% of the companies have less than 10 employees The biggest companies operate in multi-activities	- Integration of maintenance services in a whole life thinking – contractors extending their activities to include services - Integrate delivery through partnering - Innovative processes to eliminate waste within the whole construction process - Construction automation systems to replace human labour in all hazardous conditions - Security and Safety: Security at work and in systems**.** Data security - Development of tools for the analysis of indoor Environment Conditions - space models for the visualisation and virtualisation of the indoor Environment. - Energy efficiency of alternative building structures and alternative solutions for technical building service systems. - Management of material flows, project management and electronic information transfer of the subcontractor network - Wireless, open and modular system in real estate Environment. - Architecture for the wireless data transfer in buildings. - Tools and techniques for capturing and sharing good and bad construction practices across supply chains and preferred project partners - Development and use of model based applications for total-lifecycle design and maintenance in inter-enterprise setting

Products manufacturer	Wood and metal products are the strongest constructions industries in Finland	-Simulation of production processes - Application of information and communication technology to the recording of in-use performance of systems, components and whole structures - Materials durability which requires less maintenance - Eco-friendly processes and products - Refining of methods to enable to test the performance of materials and components to be predicted under different Environmental scenarios -Application on nano-technology in construction materials in order to develop products with new combination of strength, durability and toughness - Development of product catalogues and product libraries - Smart product components - Sensor technology for building maintenance - Tools for building automation
Products distributor	3529 wholesales with join turnover of 12M€ 2946 retails with join turnover of 5M€	Increase of e-commerce and sharing information with suppliers and clients
Services providers	Maintenance and repair services and Management of projects. Big construction companies are expanding to these activities	-Basis for life cycle services: including contents of services, contract models, validation of service performances, risk management methods, new logics for making business, energy performance contracting, total life cycle delivery of technical system entities - Acquisition processes to improve the availability and accessibility of such services from the point of view of building owners. - Develop of an open method for managing real estate information in co-operation with clients and service suppliers. - Methods for learning and the Smart management of indoor Environment control for system Integration of technical building services. - Simulator based solutions for training purposes. Ease the start-up training of new products with the use of modern tools and speed up product development and testing.

France

Actor	Technology and market tendencies	Driver(s)	Examples
Contractors	Dry assembly	Productivity, quality, work conditions	2D and 3D Prefab systems (concrete, steel, wood, composite)
	Sustainable process	Environment protection Productivity	Reduction of wastes on the building site Optimization of resources (water, energy, …)
	Communication systems	Safety	Site Safety e-learning IT tools to control site machines (cranes, …)
	Simulation models	Quality	IT tools to predict site activity/organization Remote control of site progress
	Life cycle cost approaches	Regulation, Environment	BOT – PPP - PFI
Manufacturer	New materials	Quality Environment protection	High performances insulation material
	Communication systems	Productivity Health concern	e-catalog traceability
	Sustainable/green product	Environment protection Health concern	Renewable energy powered systems (solar, wind …) Ventilation systems
	New equipments	Environment protection	High efficiency equipments (HVAC, water heater, …) Photovoltaic tiles, windows, panels, …
Product distributors	Communication systems	Quality, Client satisfaction	Data exchange with manufacturers (technical, maintenance, …)
	Promotion of green products/ devices	Environmental sensitivity of the client	Low energy equipments (light bulbs, heaters, …)
	Communication towards women	Marketing	Promotion of light weight products (tools, construction products, …)
	Financial tools to attract new clients	Marketing	Development of cards attributing points and discount to the most faithful clients
	~~Training cession~~	~~Quality, Client satisfaction~~	~~One day training to explain the client how to use some products~~

Actor	Technology and market tendencies	Driver(s)	Examples
		Promotion of products	
	Logistics service	Image, marketing,	Just-in-time on demand products delivery
Service providers	Communication systems	Competitiveness	Data base (capturing)
	Building performance Certification	Quality, Environment concern, regulation	Energy performance Certificate of building, green label for building
	Energy efficiency services	Environment, client	Long term contract to invest in energy efficient systems
	Technical management of building	Competitiveness	Widespread use of Sensors in the building / Building equipment controlled by computer
	Performance measurement system	Client	Key performance indicators

Poland

Actor	Technology and market tendencies	Driver(s)	Examples
Contractors	Prefabrication, manufacturing	Low Cost, Higher Safety, Reduction of the Erection Time	Prefabricated houses, Prefabricated house modules – fast and easy to assembly
	Modern Management Methods	Client needs – Time, Safety, reduction of mistakes, Industrial Safety Legislation	Sensor Networks – controlling, PDA – based Sensor tools at construction site, Elements Identification System on building site, IT management, Modern management employees hierarchy on the site, Higher skilled, better educated managers
	Environmental Impact of construction	Legislations,	Construction Environmental impact minimalise
	Work quality	Client Requirements, Safety, Long term responsibility, Warranties, requirements	Well-paid, well trained industrious workers
	R&D	Competitiveness	Public founds, more money for R&D in companies
	Compatibility	Integrated design	Integration of Material, structural, erection, usage and maintenance design
	Communication	Productivity, Mistake reduction	Good Communication between all actors. Compatibility, ICT tools, (same software usage, ect.)
	Coordination	Mistake reduction	Good coordination necessary, Less space on building sites, no magazines on building sites, ICT tools needs
	Aging population – changing social needs	Legislation	Accessibly of buildings/building areas regulations and its implementation
Manufacturer	New Eco friend materials	Public founds, Public promotion and consent, Client requirements	Plasterboard panels made from synthetic gypsum obtained as a product of desulphurization process in power stations
	Compatibility	Integrated design	Integration of Material, structural, erection, usage and maintenance design
	New manufacturing	Quality, costs	Adaptation of manufacturing methods to construction from hi-

Actor	Technology and market tendencies	Driver(s)	Examples
	techniques management tools		tech manufacturing markets like automotive, industrial, ICT etc.
	Logistics	Requirements, mistakes reduction, warehouses areas high costs	Very good coordination between contractors, designers and material providers
	Communication	Productivity, Mistake reduction	Good Communication between all actors. Compatibility, ICT tools, (same software usage, ect.) Provide good contact with product providers, contractors and designers (design for manufacturing)
	Compatibility	Integrated design	Integration of Material, structural, erection, usage and maintenance design
	Quality of life improvement	Higher restricted requirements, public promotion	Acoustic partition properties, Modern HVAC technologies, ICT
	Flexible design, Longer span, reduction of weight, size and space	Very high requirements, Safety legislations, Less space in cities	New materials, FRP composites, Aluminum, Reduction of weight, size and space
	Elaboration of the design criteria with close cooperation with a end-user and society's requirements	Client Needs	Advanced use of ICT technology
	R&D	Competitiveness	Public founds, more money for R&D in companies
	Compatibility	Integrated design	Integration of Material, structural, erection, usage and maintenance design
	Communication	Productivity, Mistake reduction	Good Communication between all actors. Compatibility, ICT tools, (same software usage, ect.)
Service providers	Safety, New maintenance Techniques	Legislation, Safety Requirements	Building Monitoring (fire Sensors, etc.), Security Systems (access control, etc.)
	Energy Savings, Increasing of Energy Prices	Public Founds, costs, Public Promotion and Consent, policies	Energy Efficient Building System, Building Energy Renovations, energy Consulting, Heating – Time – based

Actor	Technology and market tendencies	Driver(s)	Examples
			Control, Lighting Control Methods, Highly Energy Efficient HVAC technologies
	Life cycle Cost Management	Costs, Policies,	Life cycle Cost Management systems for construction industry
	Long durability	Long term responsibility, Client requirements, Warranties	Low maintenance structures (self cleaning surfaces, long durability FRP structures, etc) Protections design (fire, water, salt, etc.), Design based long term durability
	Compatibility	Integrated design	Integration of Material, structural, erection, usage and maintenance design
	Communication	Productivity, Mistake reduction	Good Communication between all actors. Compatibility, ICT tools, (same software usage, ect.)

Spain

Actor	Technology and market tendencies	Driver(s)	Examples
Contractors[4]	Increasing productivity	Low productivity and high costs correcting errors	– Industrialisation, – New management, production and design systems, – New materials with improved characteristics, – Integrated information structure, – Innovative techniques for construction, rehabilitation and de-construction, – New tools for the capitation of workers.
	Respect for Environment	Global warming, scarce resources	– Recycling of residues generated during the life cycle – Consider Environmental impact of design and construction – Positive energetic balance of buildings and urban Environments – Minimize effects greenhouse gasses – Close water cycle – Optimization of soil use and protection of natural zones – Improve energy efficiency of infrastructures – Sustainability of materials, buildings and infrastructures
	Improve security	High number of accidents in sector	– Minimise presence of workers in areas of risk, – Construction as total security sector, – Continuous training with advanced technology, – Safe machinery.

[4] Source: Strategic Research Agenda. Spanish National Construction Technology Platform. July 2006. http://www.construccion2030.org/ficheros/agenda/AEI_v1_0-final_julio06.pdf

Actor	Technology and market tendencies	Driver(s)	Examples
			– Methodology to analyse causes of accidents, – Integral security systems. –
	Improve quality of life	Demographics, higher requests clients	– Buildings and urban Environments meet citizen needs, – Intelligent systems that interact and communicate with citizens, – Security and comfort based standards, – Integral management of Cultural Heritage, – User based design, – New Sustainable urban planning tools, – Access for all.
Manufacturer	New materials	Durability, Environment protection, facility of use	– Value added insulation, – Structural materials, – Self-cleaning, – Light weight, – Durability.
	Improved knowledge about behaviour materials	Higher requirements clients	– Degradation phenomena for the increase of service life. – Multi-functional materials, – Combinations of materials.