

1.2.1. STUDY OF MOST USED MATERIALS IN ROMANIAN CONSTRUCTION SECTOR

OERCO2
ONLINE EDUCATIONAL RESOURCE FOR INNOVATIVE STUDY OF CONSTRUCTION
MATERIALS LIFE CYCLE

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ROMANIA
GREEN
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Centro Tecnológico
del mármol, piedra y materiales



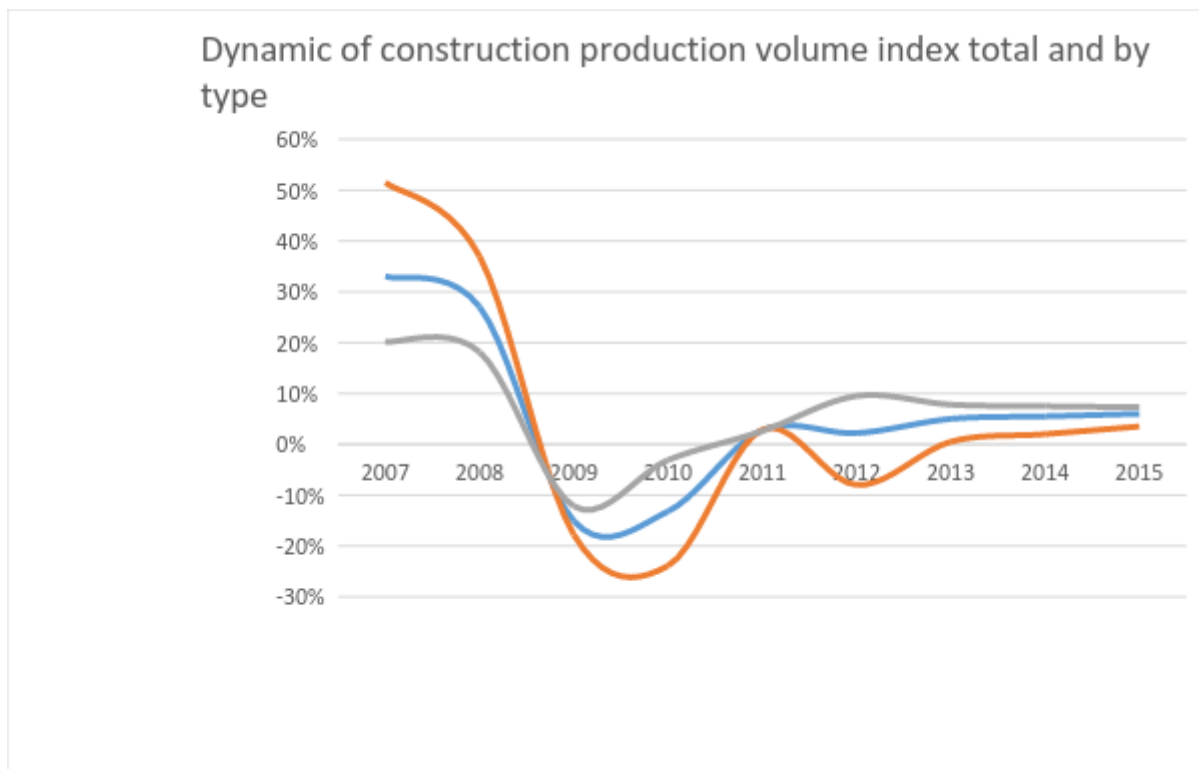
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1. Introduction

In Romania the awareness on green buildings and sustainable construction materials increased significantly for the past 10 years. The first LEED and BREEAM certifications appeared in 2008 - 2009 with currently having 93 certified buildings, 39 BREEAM, 21 LEED and 3 DGNB and over 4600 homes and apartments certified or in progress within the GREEN HOMES certification scheme developed by Romania Green Building Council for the residential sector. (RoGBC, 2017)

Soon after the EU affiliation, Romania experienced a huge boom in real estate developments with urban sprawls, high volume and low quality construction projects and severe environmental degradation. The volume of the construction works in Romania has registered an increase of 9.9% in the first nine months of 2015 compared to the first nine months of 2014. 30,540 construction permits have been released for residential buildings in the first nine months of 2015 in Romania, a 5.2% increase compared to the first nine months of 2014.

The real estate developers launched new office buildings, malls and industrial parks in Romania in 2016, with the cumulated surface of over 700,000 sqm, following total investments of over 800 million EUR.



Source: National Forecast Committee, National Institute for Statistics

During the construction boom there was little to no concern about the type of the construction

materials used, the main goals for most of the developers being cheap materials and labour and high home values on the market, with profit being the main priority and polystyrene the main insulation material. This occurred mainly due to the subsidies in public money towards the so called “thermo-insulation” of the residential apartment buildings supported by the Ministry of Development (Ministry of Development, 2016) and to the increasing lobby of the polystyrene industry. The financial crisis hit Romania the most between 2009 - 2012. This influenced the building sector by slowing down the business as usual and by seeding the interest in certain investors to improve and transition towards better and greener buildings (RoGBC, 2017).

The improvement of the energy efficiency, including of the buildings, become a strategic goal of the national energy policy in Romania, mainly due to pressure from Brussels. Increasingly, the topic of energy efficiency in buildings was taken into account when building new residential parks, office buildings, commercial and industrial facilities (FRD Center Market Entry Services, 2016).

In 2014, Romania Green Building Council developed a low cost but comprehensive Green Homes certification to assess and recognize the top performing residential projects utilizing sustainable construction principles. The certification recognized local, accessible, natural, durable and non-toxic construction materials via a scheme that evaluated the sustainability performance of the construction products published in a directory on the RoGBC official website named GREEN HOMES Approved products (RoGBC, 2017).

Currently, the market is on a growing demand of high performance buildings that use FSC certified timber, responsible sourced construction products certified BES 6001 relevant for products from foundation products such as cement and steel to concrete pipes or GREEN HOMES approved construction materials.

Moreover, at the end of 2016, the Ministry of Environment launched a grant program that will award up to 10 000 Euros per homes that use natural organic materials in order to support the development of products such as hemp insulation and hempcrete, sheep wool, recycled cotton-denim, cork, cellulose insulation and other natural organic similar insulation products (The Environmental Fund, 2016). This contributed to raising awareness and also setting higher sustainability performance targets for construction of residential buildings and homes. Also, a second program launched by the Ministry of Environment supports companies in purchasing technology for natural - organic material production.

In 2016, the Institute for Urban Studies (URBAN - INCERC) issued the first technical testing certification for HEMPCRETE and a contest was launched by the producer company which offered free hempcrete material for one house. Over 30 contestants participated and hundreds showed interest in using the product.

However, at the beginning of 2017 the polystyrene industry, long established in Romania, with over 100 000 people working in this sector, attacked the recent changes in perspective promoted by the central Romanian authorities. Their main success was in removing the mineral wool from the list of the sustainable materials promoted by the Ministry of Environment arguing that mineral wool contains toxic compounds such as formaldehyde. The Ministry of Environment could not argue against these allegations due to the very limited offers in the market of free formaldehyde mineral wool.

The RoGBC GREEN HOMES Approved Solution Providers recognised green performance for 46 companies that offer green products and services and is the main directory in Romania focused on evaluation and promotion of green construction materials (GREEN HOMES, 2017).

The local legislation and European Directives such as the Waste Framework Directive (2008/98/EC) require significant recovery and recycling measures to the construction process. By 2020, builders must, for example, divert at least 70% of construction and demolition waste from landfills. OUG 68/2016 establishes progressive rates such as a minimum 30% from the quantity of waste generated from the construction activities in 2017; minimum 45% in 2018; minimum 55% for 2019 and minimum 70% for the waste generated of the 2020 construction activities. (MMAP, 2016) European strategies toward a Circular Economy propose actions and incentives for Member States to move quickly in this direction. In the same year, 2016, the nZEB legislation for energy efficiency was approved by the government with ambitious targets for 2020.

Also a new improved Security and Safety Standard - Indicativ P-118/2016, that excludes all materials that are below A class fire security for insulation materials was launched in public debate at the end of 2016. A class fire resistant includes stone wool and excludes polystyrene, which heated the debate again with protests from the polystyrene industry (Ministry of Development, 2016).

RoGBC is currently participating in numerous actions supporting a Circular Economy through advocating for property tax reductions for buildings that achieve deep green performance targets, its Green Homes & Green Mortgage program, and involvement in three European Commission - supported projects addressing waste and construction materials assessment and improvement. One in particular, BUILD UPON, a European project funded by the Research and Innovation Program Horizon 2020 that includes Green Building Councils across Europe, managed to work with government, academics, NGOs, industry and citizens to improve the design and implementation of National Renovation Strategies. RoGBC organized a collaborative set of recommendations in the Declaration in 10 Points; with recommendation #7 being:

"The strategy must protect Romania's fragile nature and natural resources through sustainable

construction practices and a "circular economy" approaches that disconnect economic growth from destruction and scarcity."

- Stakeholders of the BUILD UPON project in Romania

At community level several municipalities adopted the "zero waste" methodology with solutions to reuse and recycle construction waste in urban mining community centers, eco-design and green building certification schemes and promoting support programs for natural - organic materials. (Chirica M., 2017)

In the commercial area, the newest trend is urban revitalisation and reconversion of industrial spaces. Over five such projects are scheduled to become LEED or BREEAM certified in 2017 - 2018. Also, the new Government elected at the end of 2016 included in its governmental program the rehabilitation of contaminated sites (brownfields).

2. Evaluation of the materials and operational solutions most used in construction

The housing stock in Romania is very old, about 60% of total locative spaces being built before 1977. If the normal lifespan of a building is 50 years, then it can be said that in Romania homes have overcome life and are exposed to accelerated degradation.

While the prices for new homes are still high, the population will focus to the renovation of old houses or build a new house, usually on own account.

Regarding the non-residential building stock (commercial, logistics, industrial, hotels), Romania is far behind other countries in the region, so there is a great potential for development.

Usually, buildings were built in areas without development perspective, without studying the market needs and sustainable purchasing power, which is why it is needed to re-think several projects. Industrial facilities will continue to search for, because there are facilities that should be moved outside the city. Chain stores are still opening new locations (Interbiz, 2014).

Residential construction has been the major driver for construction sector growth in the past years. Increased income, lower loan rates and continued government support had a positive impact on the Romanian residential market.

The construction materials most used in Romania are concrete, masonry, steel, timber, polystyrene, mineral wool, limestone, ceramic tile, metal tile, OSB, wood floor, PVC, glass fibres, asphalt, bolts, joining elements, welding electrodes, pipes and fittings, refractory bricks, antacids, insulation, prestressed concrete, adhesives and VOC paints, polyurethane foam, silicon, rubber, plasterboard panels.

According to the Order of Architects (OAR), Romanian residential buildings contain the following construction materials:

- Concrete: represents more than 40% by weight of employed in construction materials.
 - Autoclaved aerated concrete represents more than 25% of the total construction materials by weight which competes with bricks - 15-20% by the total material used in residential building constructions in Romania or timber structure used for lower than 10% of the Romanian buildings, especially for vacation homes of rural area homes.
 - Polystyrene - synthetic material commonly used as insulation material in Romania with over 80% of the current market to the low price and ease in installation procedure (Papp A. et. 2016).
 - Gypsum cardboard is the main material used for interior finishes;
 - Ceramic tiles and metal tiles for roofs. Metal tiles gaining a bigger market share for the past 10 years due to the more accessible cost and ease of installation;

In the case of commercial buildings the main material used is metal - over 60% of the total volume of construction materials used and gypsum boards for interior.

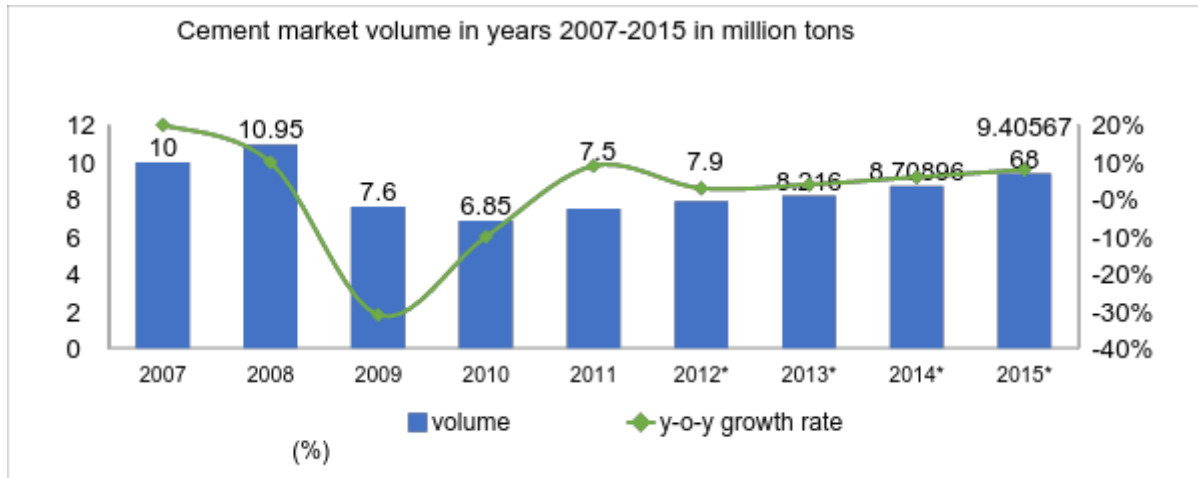
Concrete (cement and aggregates)

Concrete (and aggregates sector) was (and is still) confronting several problems like: black / grey market” practices, sub-standard products, illegal raw materials exploitations, or environmental issues. In the past years, measures have been taken to improve the situation, at both authority and private level. Also, a change in user preferences helped this sector growth: more and more final users ask their concrete to be delivered as “ready-mix product” by specialised concrete stations instead of obtaining it on site, with the help of their own more or less modern installations.

The most notable action taken in order to assure a minimum quality for the products offered on the market was the implementation in July 2008 of the “Code of best practices in concrete production”. The code was a joint project between state institutions and some professional associations with the purpose of ensuring minimum safety standards for new construction in Romania (Marketscope, 2012).

The need of concrete is increasing as the strong growth of the Romanian construction sector.

The concrete is a mixed of cement, aggregates and water, and, as the cement sector is increasing, so is the concrete one:



Source: Previous research, desk research update, Marketscope estimates

In cement production, environmental issues and an underdeveloped market were the major problems in the past years: technical and environmental status of the factories in Romania was well below European norms & regulations and related international standards, while the market was undersized. The situation changed due to the impressive investments made by the companies in the past years: today, all the factories have integrated environmental permits in accordance with the European Union legislation.

In Romania, cement is used in the production of three main product categories (which contain cement in shares ranging from 10 to 20%):

- wet or ready-mix products (concrete, mortars and blanket compounds);
- solid compact products (AAC, concrete prefabricated products – roof tiles, pavements, etc);
- solid powder products (adhesives, plasters, dry mortars and self-levelling compounds, etc.).

The main use in terms of volumes needed is the obtaining of wet or ready-mix products (accounting around 75% of the cement used). These compounds have a large usage in the construction sector and are delivered already prepared by specialised stations or are mixed onsite by final users with own mixing equipment.

Wall building materials

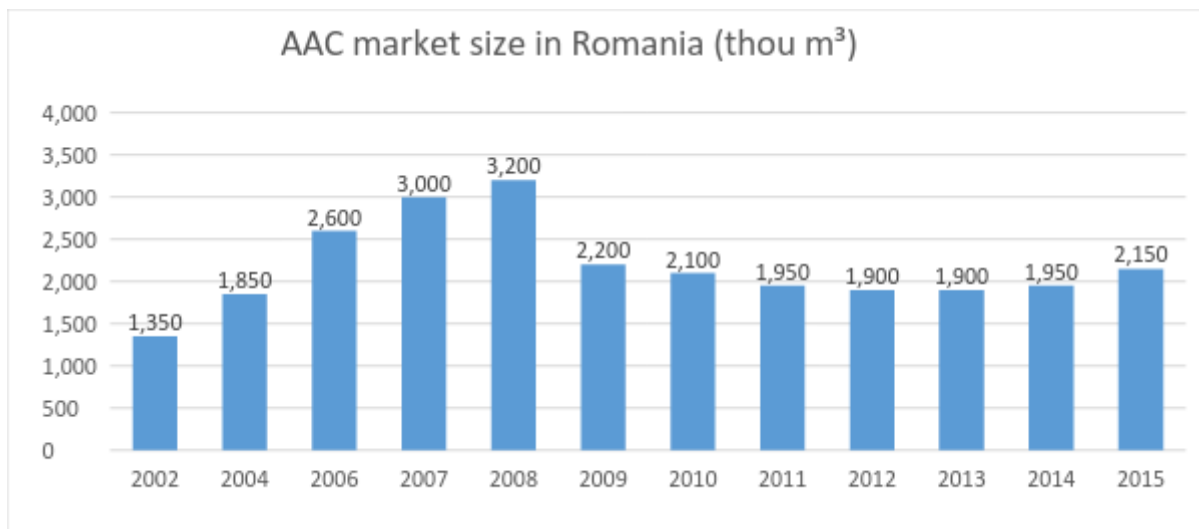
Wall building materials used in Romania are AAC and clay/ceramic bricks, which account together for almost 80% of the wall building materials sector. A peculiarity of the Romanian construction sector is that, in addition to the two major product categories mentioned above and other usual types of wall building materials (e.g. timber, concrete blocks, prefabricated panels, etc.), there are two wall building materials that are produced and used by handcraft, namely trellis works

and adobe (used primarily in poor rural areas). Although their role should not be neglected, the relative importance of these materials is low and will most likely continue to diminish (Marketscope, 2012).

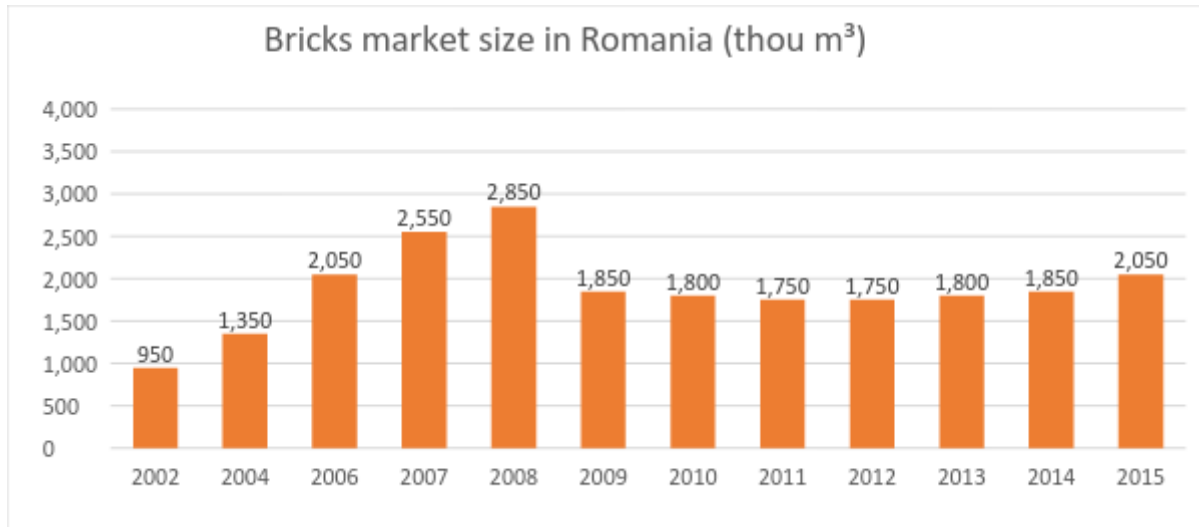
% Structure of WBM sector in 2016	AAC 42.4%	Bricks 37.6%	Other 20%
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Source: Previous research, Marketscope estimates, www.agendaconstructiilor.ro

Bricks registered stronger growth rates in the past years as compared to AAC and managed to reduce the gap on AAC. However, AAC is still the wall building solution of choice for larger structures (especially in urban areas). Regarding materials used in construction of homes, consumers seem to prefer bricks, though in recent years, a part of this segment of consumers seems to have focused on AAC.



Source: Previous research, Marketscope estimates, www.agendaconstructiilor.ro



Source: Previous research, Marketscope estimates, www.agendaconstructiilor.ro

Timber holds around 8-9% of the market and its popularity is slightly growing (especially in rural areas with low flood risk and / or high earthquake risk, and for summer / vacation houses) as it is cheaper than both bricks and AAC (Marketscope, 2012).

Thermo-insulating panels are one of the most complex construction solutions, as they fulfil multiple roles: cladding or roofing solution, thermal insulation, fire proofing, etc. They are called informally “sandwich” panels because they consist of two galvanized metal sheets with a thermal insulating core (polystyrene, mineral wool or polyurethane). Due to quickness in assembling, they are an ideal solution for wall or roof covering of non-residential projects (logistic centres, industrial buildings, retail centres).

Insulating materials

The products offered on this segment often have multiple insulation properties:

- thermal insulation (polystyrene and mineral wool are the most used materials)
- hydro
- acoustic
- fireproof insulation.

The market has registered large growth rates in the pre-crisis years and continues to have high potential due to the regulations adopted at EU level that requires buildings to have a thermal insulation certificate. This document attests the thermal efficiency of a building and will be needed when selling a locative space. New buildings and residential parks are designed to be

thermal efficient, but there is a great number of old buildings that need thermal refurbishment.

In this respect, a governmental program has been initiated in 2002 – rehabilitation of the national dwelling stock – through which the cost of insulating old buildings was state-subsidized by two thirds of the total value. The program had enjoyed little success in the past years. However, new regulations providing standard projects for various types of blocks of flats and financing through European Funds reduced both time and money needed for applications to the program. In Romania, there are approximately 80,000 blocks of flats (among which 50-60 thousand need to be thermally rehabilitated), of which only around 1,000 – 2,000 have been rehabilitated through this program (Marketscope, 2012).

The most used thermal insulation material in Romania is expanded polystyrene (EPS). The second is mineral wool, which could be glass or basaltic.

% Structure of thermal insulation materials in 2016	Polystyrene 68.5%	mineral wool 28.5%	Other 3%
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Source: Previous research, Marketscope estimates, www.agendaconstructiilor.ro

It is expected that in the following years, the share of mineral wool in the thermal insulation market to increase. As the demand for wool insulation systems will grow predominantly due to industrial and commercial projects, the orders EPS will become higher in particular because of the works of thermal rehabilitation of housing buildings.

Product use:

- expanded polystyrene has thermal and acoustic insulating properties and is used for plastered facades, ventilated facades, exterior and interior walls, non-circulated, low traffic or intense traffic terraces, heated floors, sloping roofs, wood-structured floors;
- extruded polystyrene is used for the thermal insulation of foundations and basement walls, interior/exterior heated/unheated floors, new or renovated buildings' facades, roofs and terraces, pillars, beams;
- glass mineral wool is used for thermal insulation and soundproofing of attics, exterior walls, intermediate floors, gypsum-cardboard walls, metal profile building systems or industrial equipment;
- basaltic mineral wool is an excellent thermal insulating material, also with fireproofing

and soundproofing qualities, used for buildings (outside and inside walls, bridging, attics, and terraces), industrial buildings made of reinforced concrete or metal;

- bituminous membranes are used for hydro insulating of foundations, roofs, terraces, garden roofs, inversed or curved roofs, metal floors, parking, street passages, basements, bridges, viaducts, drains, galleries and tunnels, irrigation canals, tanks, swimming pools.
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Insulating window and door systems

Sector for the insulating window and door system carpentry shows that Polyvinyl chloride (PVC) holds 70%, while aluminium profiles account for 20-25% out of the total market and are followed by wood and other materials which account for 5-10% (including aluminium-PVC, polypropylene etc.) (Marketscope, 2012).

% Structure of insulating window and door systems in 2016	PVC 70%	Aluminium 20-25%	Other 5 - 10%
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Source: Previous research, Marketscope estimates, www.agendaconstructiilor.ro

The most frequently used profile is the 5-chamber PVC one with grade A (thickness of exterior walls of the profile > 2.8 mm).

Wood profiles are usually high-end products due to high prices and lack of technology for automated production lines.

Roof tiles

There are several roofing solutions used on the Romanian market: metallic tiles and profiled sheets, concrete tiles, bituminous and fibreglass shingles, roof ceramic tiles, corrugated bituminous roofing, wood shingles and, to some extent, asphalt cardboard. Out of these alternatives, metallic tiles, concrete tiles, ceramic tiles, bituminous shingles and corrugated roofing are preferred (Marketscope, 2012).

The sector registered different dynamics for each component segments, with metallic tiles having the largest growth in the past years. A large part of demand seems to be represented by renovation projects. However, there seems to be a growing number of recently started

construction projects for industrial and agro-industrial sectors (production halls, warehouses, farms etc.).

% Structure of roof systems in 2016	Metallic tiles 49.8%	Ceramic tiles 17.2%	Concrete tiles 10.6%	Bituminous shingles 3.2%	Bituminous corrugated roofing 9.2%	Other 10%
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Source: Previous research, Marketscope estimates, www.agendaconstructiilor.ro

Steel and prefabricated concrete elements

The sector of structural elements consists of prefabricated concrete building components, structural metallic frames and cladding solutions. These products are designed especially for commercial, industrial or infrastructure construction and have the advantage of a quick assemblage; this makes them an ideal construction solution considering the conditions in the construction sector: the lack of qualified workers and short deadlines made the demand for quick assembling building products to grow considerably in recent years.

% Structure structural elements sector in 2016	Steel components 75%	refabricated concrete components 25%
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Source: Previous research, Marketscope estimates, www.agendaconstructiilor.ro

Flooring materials

Main flooring products in Romania are ceramic floor tiles, parquet and wall-to-wall carpets.

Flooring products have registered a significant drop in 2009 (approximately minus 30%), in both new building construction and refurbishments. In the past years, the tendency has stopped and now there is a slightly improvement.

Regarding the quality segmentation, most consumers seem to select “economy / budget” ceramic tiles products at a retail cost of 4 – 6 EUR / sqm. Recently, consumers seem to prefer large tiles (20X40 cm or 25X40 cm) instead of small ones (20X20 cm or 30X30 cm). Also, most consumers seem to prefer elegant, decorative tiles with different colours or decorations

(Marketscope, 2012).

Laminated flooring products are not considered as part of the parquet sector, but this solution is still preferred in Romania due to the low budget required. Laminated flooring is estimated to hold approximately 80% of the total parquet market. Although the share of this product is expected to slightly diminish, the income of the average Romanian is still too low for massive wood to become the number one choice in the residential segment. As a consequence, massive wood parquet sales are still rather modest in Romania.

In residential areas some products are preferred:

- laminated parquet is the preferred solution for cost-effectiveness and easiness in mounting and maintenance; also gives possibility of “stylish” combinations with small carpets;
- wall-to-wall carpet is “warmer” and absorbs sound.

And in non-residential areas preferred products are:

- wall-to-wall carpet in new offices, hotels and exhibition centres due to thermal and sound insulation properties, variety of models and, sometimes, lower overall price;
- ceramic tiles, PVC and other industrial flooring solutions in commercial spaces, hospitals and other special public places, due to easier maintenance and price.

In standard buildings that do not follow a green building certification scheme the main rule in choosing the construction material is cost. However, within the GREEN HOMES approved materials certification scheme the evaluation includes:

- Recyclability and compostability;
- Repairability and reusability;
- Toxicity and durability.

Thermography and VOC testing on site is mandatory for all GREEN HOMES certified apartment building.

According to a recent study, in 2015 the residential construction sector increased by 10%, however in 2016 there was a minimum of home sales registered for the past five years due to the mortgage policies. The commercial real estate had a huge boom in 2016. In Bucharest only the developers delivered 360000 sqm of office building, meanwhile at national level 15 new malls and retail centers from which 70% in progress to obtain BREEAM or LEED certification were build (Badea C., 2016).

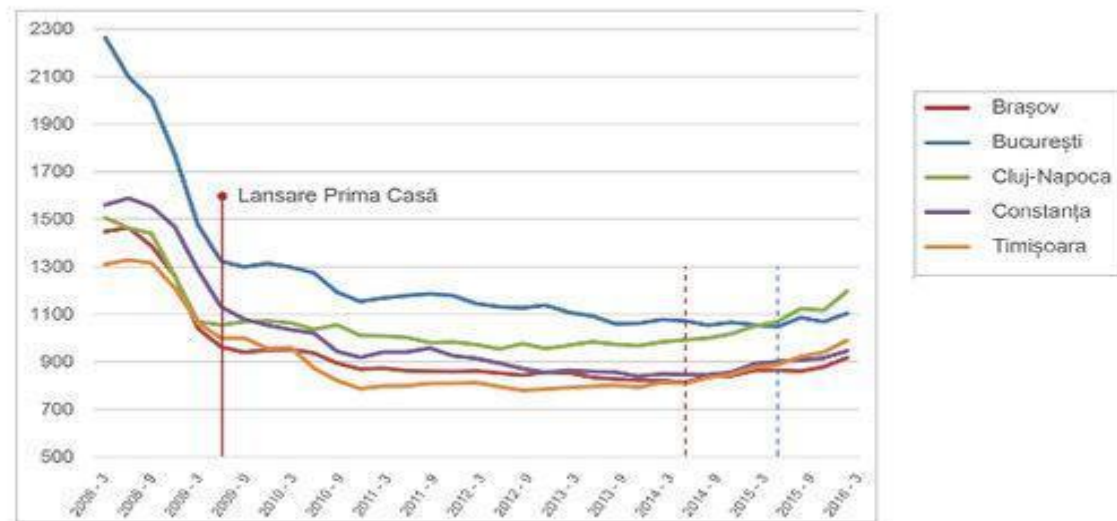


Table 1.1: Residential sector evolution based on quantity of homes sold between 2005 and 2016 in 5 major cities

Evoluţie suprafaţă

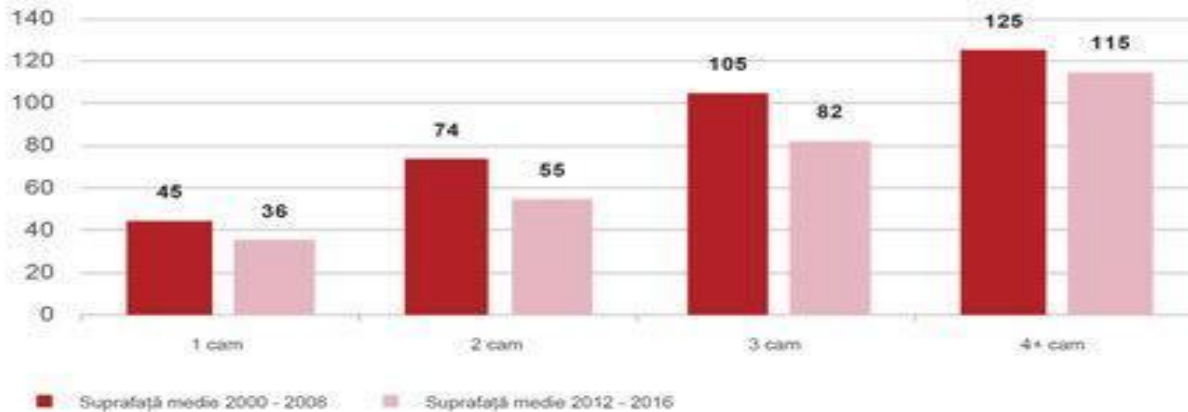


Table 1.2: Analyzes of the residential sector evolution based on floor area. Comparison between 2000-2006 period and 2012 – 2016

3. Evaluation of the materials and sustainable solutions most used in construction

The construction regulatory system in Romania is a traditional one where the majority of the laws, standards and norms are adopted and enforced from the central government level. The local public authorities can intervene at the local level only regarding local planning

requirements.

There are some laws (Lg50/1991, Lg10/1995) which regulate at a general and global level (for all buildings), and there are also many laws and regulations for specific functional categories of construction (residential, hotels, office buildings, schools, hospitals etc) (Flanders Investment & Trade, 2013).

Regarding new buildings, sustainable construction aspects are very little or not at all covered in existing legislation in Romania. Unfortunately there are no specific instruments / regulations used by the government or the local public authorities to encourage the usage of local workforce and local construction materials in sustainable construction. However, there are some topics related to ecological quality: every construction needs to obtain an environmental permit or environment impact assessment in order to get the Construction Authorization.

Rules which apply to new buildings, also apply to existing buildings. These rules include energy, waste management, economic quality and technical quality. There are hardly any rules which also apply to renovation of existing buildings.

Over 90% of the sustainable solution most used in construction in Romania are materials and products certified either under GREEN HOMES approved solution providers, either BES 6001, FSC, PEFC or ecolabel products. The rest of 10% represent the so called alternative materials and technologies such as cob, adobe or straw bale systems (Nemeth J., 2016).

In LEED and BREEAM the most used LCA tools are IES and 360 Optimi. The latest offers the maximum number of points in both certification schemes. Other used tools include Gabi and Athena (REGREEN, 2017).

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