



BUILDING INNOVATION IN THE EUROPEAN CONSTRUCTION SECTOR

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1 Introduction

Build Nova Report D.10 analyzed available finance guiding materials and concluded that further improvement and innovation in construction may look for lacks of different resources, such as financing resources, qualified personnel that could lead the internal innovation processes, an insufficient innovation culture and insufficient cooperation with other companies or with technological and research centers. Innovation is a complex matter and understanding the right way to foster innovation proves to be complicated as well since the interplay of different variables must be taken into account.

This D11 report of Build-Nova gives recommendations not only to our policy makers or governments, but also to the construction players in general. The recommendations are given from different perspectives (financial, Technical, Market, Administrative/Institutional and Societal) while they are finally summarised by the different types of existing players (Governments as legislators, clients and promoters, Construction companies and Investors).

2 The Need to Innovate

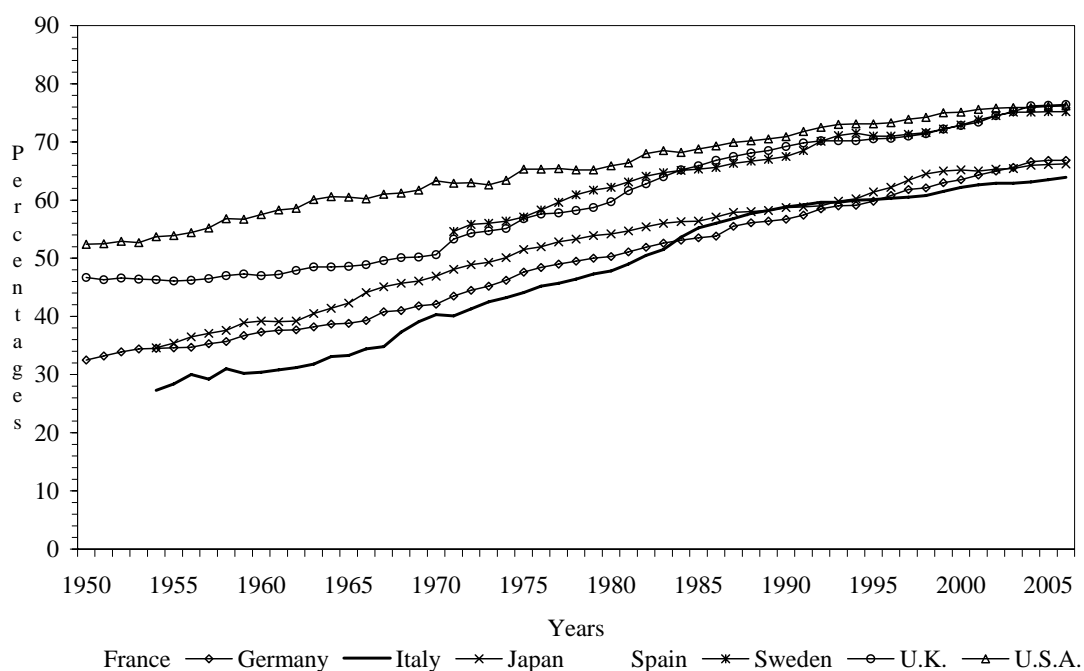
With respect to the question of what innovation really means it is necessary to operate with a wide understanding of the term innovation: Within the extremely rich literature one can go back to classic thought provided by Joseph A. Schumpeter (1911, 1964) who provided a typology of different innovation segments in order to demonstrate that innovation processes may include very different items. He distinguished between five different matters of innovation: (1.) The introduction of a *new good*, (2.) the introduction of a *new method of production*, that is one not yet tested by experience in the branch of manufacture concerned, which needs by no means be founded upon a discovery scientifically new, and can also exist in a new way of handling a commodity commercially, (3.) the opening of a *new market*, that is a market into which the particular branch of manufacture of the country in question has not previously entered, whether or not this market has existed before, (4.) the conquest of a *new source of supply of raw materials* or half-manufactured goods, again irrespective of whether this source already exists or whether it has first to be created, and (5.) the carrying out of the *new organization* of any industry, like the creation of a monopoly (for example through trustification) or the breaking up of a monopoly position (Schumpeter, 1963, 66).

Having in mind the broad scenario of interpretations and applications of innovation we should take into account that no single pattern of innovation exists but diverse ways of innovations as formerly not known “new combinations” (Schumpeter). Innovation research is an elementary part of the broader debate on stimulating economic growth. A long tradition exists in discussing how to implement further growth most appropriately and competing approaches are still coexisting although recent debate is moving towards a so-called unified growth theory “ in which variations in the economic performance across countries and regions could be examined based on the effect of variations in educational, institutional, geographical, and cultural factors on the pace of the transition from stagnation to growth.The most promising and challenging future research in the field of economic growth in the next decades would be the exploration of the interaction between human evolution and the process of economic development. This research will revolutionize our understanding of the process of economic development as well as the process of human evolution, establishing socio-biological evolutionary foundations to the growth process” (Galor 2005, p. 284-85).

Acknowledging that growth has become the strategically most crucial index of policy orientation, innovation is getting a related importance since innovation is always initiating and keeping the growth engine in motion (Schumpeter 1947, Part II, Ch. 2). One of the issues to foster innovation is fostering entrepreneurship. The link between innovation, entrepreneurship and growth (Audretsch and Thurik 2001) has become centrally proclaimed and underlined. Very much theoretical and empirical literature has been provided not only to each of the dimensions but also to their practical interplay. The multicomplex concert of entrepreneurial driven innovation as growth engine

includes a wide and open understanding of the different elements of innovation and of competition as discovery *process* (Hayek 2002, Kirzner 1973) which ultimately includes several *soft*-dimensions (besides *hard* factors as financing and given technology) as productive means, as – among others - e.g. human resources, knowledge (including educational skill and education), system of industrial relations, social and organization networks, working behaviour and mentalities (Audretsch 2002, 2007).

Creation and discovery are mysterious processes but whatever else is required scientists are reasonably certain that incentives matter (Scotchmer, preface). Innovation is the key to competitiveness in a globalised economy which opens the door to - sustainable - growth and to more employment, and innovation processes are highly embedded in societal trends towards increasing ratios of knowledge in diverse spheres (Warsch 2006). Processes of industrial renewal in the global economy and also in construction industry take place within an universal framework of permanent reconfigurations of the wider structure of economy and society. One of these tendencies is the internationally convergent process of tertiarisation which minimizes employment and companies in manufacturing and which increases employment and ventures in services. The general trend that production is becoming increasingly white colored affects the division of labour within companies as well as between them.

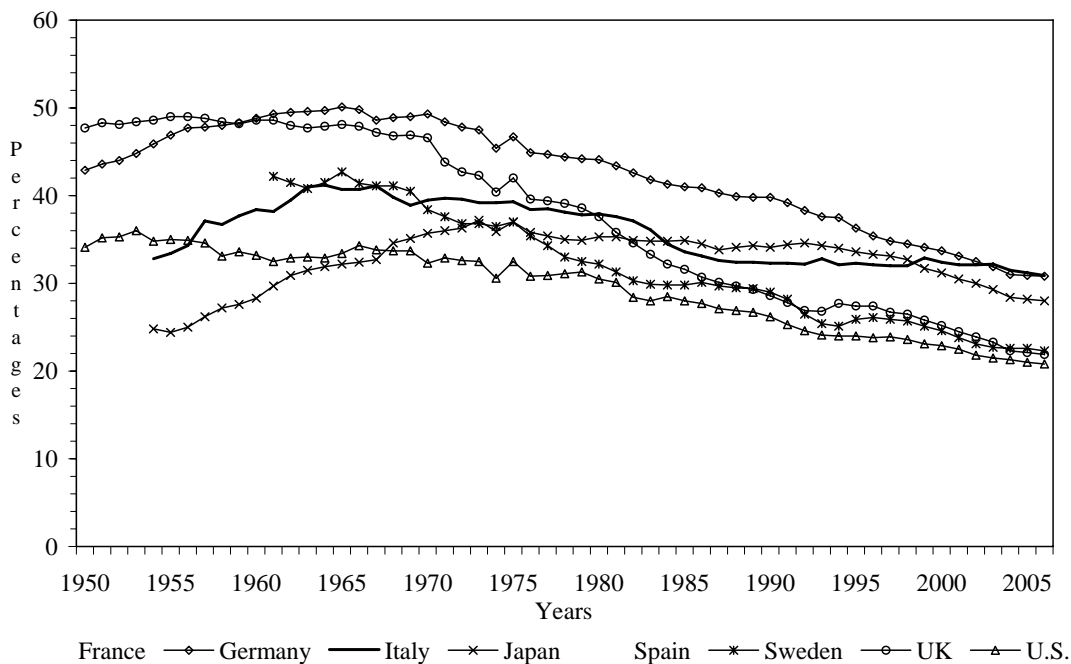


Source: Own Calculations on OECD: Labour Force Statistics, Manpower Statistics, Paris, various years.

Figure 1: Service Sector Employment on International Comparison (1950 – 2006, percentages of total employment)

Figure 1 illustrates the trend that labour markets of modern economies are increasingly based upon service sector employment. Between 1950 and 2006 the ratio of service sector employment has increased dramatically different selected countries. Figure 2

highlights the mirror curves for employment in manufacturing as shares of total employment which are going down as symptom of a historical process of deindustrialization (Bögenhold and Fachinger 2008). Shifts in the division of national and international economies need to be acknowledged in order to see potential for firm dynamics including niches for new small firms (Bögenhold and Fachinger 2007) and potentials for innovation and “creative destruction” (Bögenhold 2004).



Source: Own Calculations on OECD: Labour Force Statistics, Manpower Statistics, Paris, various years.

Figure 2: Industry Employment on International Comparison (1950 – 2006, percentages of total civilian employment)

3 Build-Nova: Innovation in Construction Industries

All what is described concerning innovation as incentive for growth is general and almost concerned with global economy. *Construction industry* hasn't been addressed explicitly, while Build Nova is – nomen est omen – explicitly and exclusively concerned with *innovation in construction*. The nature of construction industries differs from other industries considerably (see Build-Nova deliverable report D8). Service industries sell primarily services instead of goods. Manufacturers develop products, try to employ marketing and sell these products finally to customers. Companies in construction industries produce building objects primarily on demand. Construction industries react on demand, they try to get contracts by customers in order to start working along individual projects. 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. Innovation processes are running along different rules and settings. 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.

Talking about construction implies that the sector is not such a dynamic new flourishing industry as e.g. biotechnology driven ventures are. In opposite, construction industry is an economic area with a long economic, social and technological tradition. Nearly 10 percent of the GDP in Europe comes on average from construction industries, and nearly eight out of 100 people of the total labour force are physically engaged in construction labour market.

Analyzing innovations potentials and related economic challenges for the construction industry must acknowledge the diversity of the stakeholders of which the three main actors are contractors, manufacturers and products distributors. Furthermore, construction industry shows, as most other industries also do, a remarkable distribution of firm sizes. More than 90 percent 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.

Different markets must be distinguished analytically according to the different company sizes. Construction markets compete at local, national and/or global markets with their quite different institutional frameworks. While some companies operate almost only very traditionally at local places, others operate worldwide and have an up-to-date

infrastructure and they have appropriate logistics. While being active in different regional contexts companies are faced by changing constraints which provide challenges of an own nature.

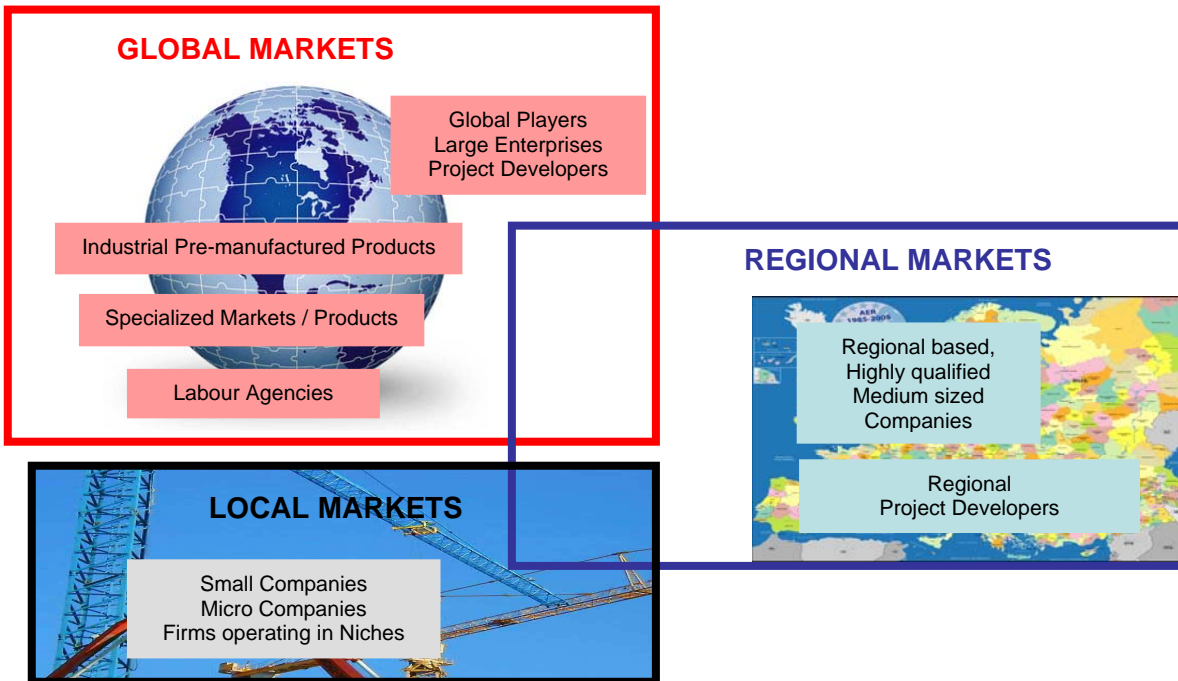


Figure 3: Different Markets where Construction Companies are Engaged

Looking at Figure 4: Contextual Model for construction (adapted from Gann and Salter, 2000) gives an idea concerning the complexity of the construction sector and the diverse relationships of the different stakeholders.

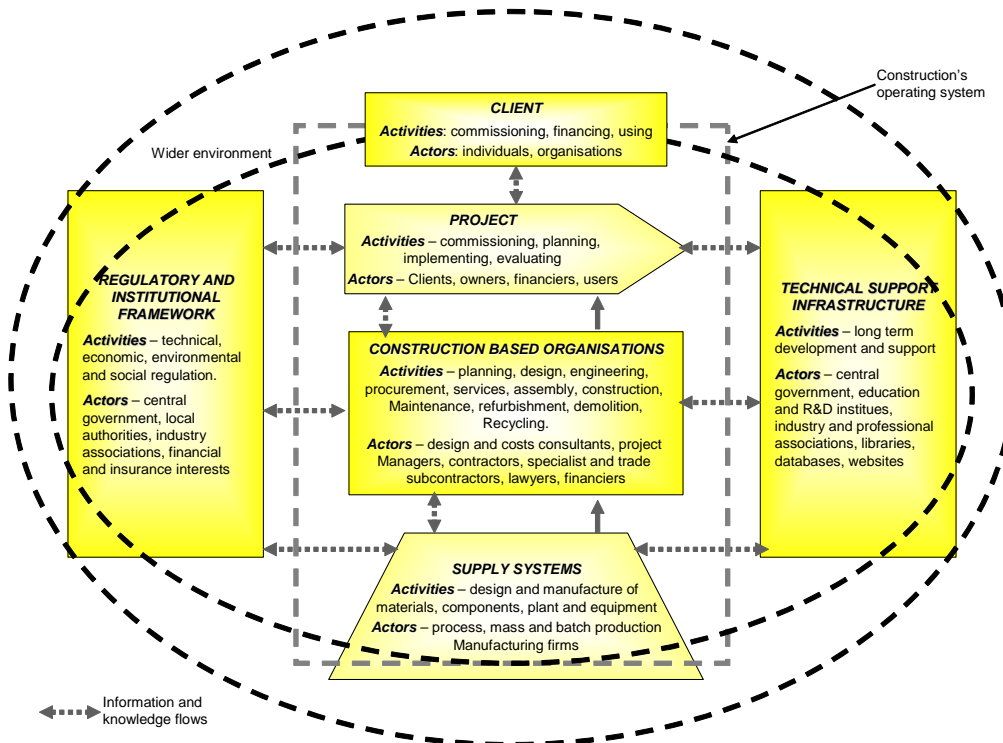


Figure 4: Contextual Model for construction (adapted from Gann and Salter, 2000)

The construction market in Europe continues being an amalgam of very heterogeneous national situations, and often particular situations are hidden under the general behaviour of the sector.

The construction sector may be interpreted differently depending on the type of actor that we are referring to. While contractors are more interested in improving processes and methods of construction, materials providers are more open to radical innovations ending in new or improved products. In between we have the components or products providers, with an innovation profile similar to other more industrial sectors. But we also have other actors with influence in the construction process, like architects, promoters, products distributors, etc.

Construction has always been considered a very traditional sector, with a very poor culture of innovation and R&D, which is sometimes true, especially in very small construction companies. Contractors, promoters, architects... many of them tend to think that construction is not the best place for new business opportunities. But even if this has been true in the past, it won't have to be the same in the near future.

The increasing societal demands for a more sustainable environment, for example, should encourage innovation in construction products, opening a window for new developments and the use of radically new materials and technologies. Buildings and construction products, taking into account their whole life cycle, account for around 40% of the total EU energy consumption, and around 50% of the extracted mineral resources. Construction is therefore a key sector for the achievement of the EU environmental objectives.

Industrialisation of the construction process, utilisation of new and improved materials, reorganisation and rethinking of management and coordination tasks, knowledge management on-site or energy efficient buildings are only but a few concepts and methods that can help mitigating the historical problems associated to construction (low productivity, labour accidents, delays in delivery times, CO2 emissions, consumption of natural resources...).

4 BUILD-NOVA Policy Recommendations

4.1 Definition of the Innovation Scope

As the aim of Build-Nova is to enhance innovation take up in Europe in the built environment in particular in relationship to finance, there is a need to identify terms and make proposals at both an overall conceptualization and instrumental levels in particular in relationship to risk. In our proposals we have attempted to distinguish clearly between the different level of innovation being addressed and innovation realities of the different players in the sector as well as how the perceived risk inherent in such activities maybe diminished, thus increasing the attractiveness of the sector for investors.

Innovation in Europe has in the recent past been dominated by science lab-based paradigms. Innovation possibilities have been less apparent in the built environment with its tradition of not only lab based but also on site incremental learning. The adoption of Pan European environmental legislation signed up to by all the Member States coupled with exciting developments in the area of new materials system processes and contract now allows for the emergence of the sector as a major innovation player and growth market sector.

4.2 From Findings to Conclusions

There is a wide range of reasons that make improvement and innovation processes in the construction sector more difficult than in the economy in general since the sectoral specific differ for reasons of lower financial resources, a lower level of qualification of human resources on average, a specific innovation culture and often lower levels of cooperation with other companies or with technological & research centers and existing difficulties of access to technological and external information resources.

Relevant subjects were selected carefully in order to get the attention of all the parties. Initiating the business fora was leaded by some basic assumptions: The technological companies have a real interest to getting in contact with investors, because they can see the opportunities of the market and admit their lack of financial resources and knowledge. On the other hand the investors normally don't like to risk their money in market or technologies they don't know enough about so.

Although an idea of an innovation lack which could be highlighted through participants is a leading perspective, innovation seemed to be too "broad" as term which led to the fact that our analysis asked for different factors being among the innovation umbrella.

We distinguished empirically between the following areas of investigation:

(1.) Financial factors

“*Financial factors*” include questions for the different kinds of sources being available, for the issues of who has how access to financial resources.

(2.) Technology related factors,

“*Technology factors*” include questions about which forms and scales of production are in operation, how fast new developments occur for which reasons and within which fields of application, which segments of innovation can be reported and where are problems to introduce new concepts, which role do investments and patenting as protection of intellectual property rights play.

(3.) Market related factors,

“*Market factors*” include the status quo of competition, the landscape of the demand and of the supply side, the question on which local, regional, national or international markets which companies operate under which conditions but also in how far special “new” developments such as a greening of industry and society are reflected: Does sustainability matter and how far?

(4.) Institutional factors and

“*Institutional factors*” include aspects of regulation related to construction businesses (law, bureaucracy, accreditation, certification, issues of guarantees among others) which could be improved for a better running of business life in construction.

(5.) Societal “soft” factors.

“*Societal 'soft' factors*” include such divergent items or dimensions as education, skilling, certification procedures, social networks, changing life-styles and newly emerging structures of demand.

BUILD-NOVA policy recommendations are based upon two different sources:

1. Build-Nova had implemented a series of business fora in partner's countries which aimed to bring together practioneers of different backgrounds. The objective is to bridge the interests of the construction innovative enterprises and the financial investors, identifying some key subject points for discussion between them and utilising these forums to validate the materials developed and to complete the information gathered during the previous phase of the project (Report D13 gives precise insight into methods and findings of the Build-Nova business fora series).

Business fora were conceptualized as living networks of conversation around questions that matter. It is an easy-to-use method for fostering collaborative dialogue, particularly in large groups. It is, simultaneously, a hermeneutic instrument to notice the often invisible webs of conversation and social learning which lie at the heart of our capacity to share knowledge and to try to shape the

future together. Using business fora as a method empowered the Build-Nova leaders, construction professionals and further “significant others” to create focused networks of conversation around an organization or community's real work. They were based on the natural process by which authentic conversations enabled people to think together, create shared meaning, strengthen community and ignite innovation. Given the appropriate context and focus, Build-Nova business fora provided dialogues which allowed members to access their mutual intelligence in the service of desired outcomes.

Relevant subjects were selected carefully in order to get the attention of all the parties. Initiating the business fora was led by some basic assumptions: The technological companies, as well as some providers of components and construction solutions, have a real interest to getting in contact with investors, because they can see the opportunities of the market and admit their lack of financial resources and knowledge. On the other hand the investors normally don't like to risk their money in market or technologies they don't know enough about so.

Build-Nova business fora served to present results which Build-Nova members had gained by their previous analysis and to confront those first results with practitioners views and to get the feed-back from the market, finance and technology representatives. This collective effort and agreement helped to build a common vision about the construction situation and to share a mutual understanding about the expected developments for the near future of the sector. All efforts together will therefore contribute to the actual scenario for innovation within the construction sector, serving as a decision taking support tool for constructors, technology firms, administration bodies and other interested parties.

The evaluation of Build Nova business fora results were driven by the general question about how stakeholders from different frontiers of practise deal with the phenomenon practically. More specifically, our research interests were concerned with the question of what could be improved in construction industry to arrive at higher efficiency. Learning to know about lacks of innovation Build-Nova had in mind to learn by those who are ultimately linked to day-by-day-practices through their practical working lives.

2. The second source through which information was systematically collected and analyzed was the evaluation of the different working reports based on sharing common knowledge provided by a sample of European professionals engaged in studies on construction. Trying to do a synthesis of all documents and their related findings in combination with the expert's “inside view” which Build-Nova gained by running business fora implies to report major rather than subtitle findings.

4.2.1 Financial Recommendations

The construction sector in Europe has not registered growth decreases for the last thirteen years; a period affected only by a couple of moments without advancing, the last one was between 2001 and 2003. After this bad patch, the sector improved the situation until 2006 where it achieved a maximum growth of a 3,2%.

A growth of the sector is expected in the following years, but in more moderate levels, particularly as a consequence of the financial crisis started in the US in 2007, which is affecting more to countries like Spain, Ireland and UK, where the house prices had the highest rises during the last decade.

Discussion of risk capital regarding innovation in the construction sector is in its infancy. For example many national statistical offices fail to address this element properly, concentrating on units of completion or employment. Venture capital backed companies in Europe attracted over €6.4bn of institutional funding in 2006. However the portion falling of venture capitalists investments made in construction is comparatively small.

Additional funding for innovation in many cases comes from the public sector. Lack of understanding, as to the potential of the sector and of the role of venture capital and other investment vehicles (e.g. micro credit, grants etc.) needs to be bridged. However, there is also evidence that innovation investment in the sector may well be a feature of contractor networks. Since we know relatively little empirically about this type of investment, systematic research could be implemented here in order to allow better decisions.

Most private investors will provide funds to projects not before they are at the commercialisation stages. This is a problem because some promising technologies may not be developed or may be developed with a delay because of a lack of funding. Consequently more public funding should become available at the demonstration phase to compensate for this kind of “market failure”.

Some barriers that hinder the entering of investors into the construction sector are the following:

- The poor image of the construction sector in terms of innovation. It's not attractive for investors
- A lack of expertise and knowledge on construction, which is an obstacle when assessing the market and technology possibilities of the new business ideas
- The segmentation of the construction market, with the majority of companies working only in their regions
- The consideration of the safety conditions of the houses, buildings and infrastructures, which make the public administrations very conservative when accepting new innovative designs or solutions

- And of course, disharmonized capital gains taxes all over Europe are not only a problem of global competitiveness but also for construction companies.

Taking all this into account, we give the following policy recommendations from the financial perspective:

- √ There is a need for public-private financing in emerging technologies to support development of new solutions and concepts in building construction. The primary emphasis should perhaps be on energy efficiency and renovation of existing building facilities including the use of new technologies (ICT, BIM, etc.) connected to changes in building construction processes. Public financing should serve as a trigger for exploration of new ideas and technologies that private financing may foresee as a high risk investment. Private financing would most likely take over once the feasibility of these new publicly financed ideas and technologies is verified. In this context, public financing is seen as a key catalyst and stimulant for research, development, and eventual take-up of new ideas and technologies for building construction.
- √ There is a need of co-operation in financing innovation and R&D on local and region level, country level, group of countries (like Nordic countries, countries of same size, Mediterranean neighbour countries ...) and EU level with help of networking and platforms / forums / clusters. The basic idea is to extend a discussion on networks, clusters and industrial districts (for a summary of existing literature on innovation see Kaiserfeldt 2005 and Karlsson 2007) and to link that discussion with the issue of financing. Financing the innovation potential of construction clusters implies financing “extra-market externalities“ (Westlund 2006) in order to arrive at positive spill over effects between “networking“ and “entrepreneurial growth“ (Johannisson 2000).
- √ There is a need for interaction between construction companies and private investors, and of course a need for a new lead market which could bring them together in the basis of new emerging business possibilities, as the sustainable construction. If the built environment is to fulfil its promise of additional employment and wealth creation become one of the outstanding lead sector markets in the EU (sustainable construction), there is an urgent need to reinforce existing sector specific fora including EU and National platforms and at a more regional level develop more thematic forum as have occurred within BUILD-NOVA to deal with an acute knowledge gap between investors and players in the sector. All parties of innovation chain must be involved in these fora: basic education, universities, research institutes, industry parties, funding agencies, private investors, innovation policy makers, ministries, etc.
- √ There is also a need for dialogue and reflection between construction representatives and public administrations, in order to adapt the building contracts to the new sustainable and efficient solutions (PPPs, FTCs, etc.)

- √ Finally there is a need to create and deploy funding and innovation programs specific for construction, at European, national and regional levels. Many often we find construction companies competing with projects not very innovative in comparison with those from other more emergent sectors and thus having problems for been selected for funding.

4.2.2 Technical Related Recommendations

From a technical point of view, we give the following policy recommendations:

- √ There is a lack of performance based standards, which implies a lack of incentives for research and innovation in construction companies in general. This must be recognised as one of the barriers that many construction companies don't want to invest in R&D. Lack of common European standards reduces the investment potential for innovative companies in the sector. Performance based standards give the possibility to implement new technologies if they meet the performance requirements. So the performance based nature of the standards is important. Today too many describing standards are used (you are restricted in the solutions you can use), thus making it difficult to implement innovative solutions along the value chain. The problem is particularly acute for the smaller Member States where national standards coupled with a small market reduce opportunities for economies of scale and fail to provide a spring board to larger markets with different standards. Such complexities lead to additional costs and reduced profitability, making innovative companies less attractive to external investors. Denmark constitutes a positive exception in the European construction sector and shows a rather aggressive construction policy inspired by a strong commercial point of view.
- √ Our recommendation is to encourage the Commission to use its standards-setting powers to demand high-technical performance levels and reach agreement on new standards quickly and efficiently. To encourage the Commission to develop a more result oriented standardisation process that supports the market take up of new business solutions more effectively. Standards should be, as much as possible, performance based, yet technology-neutral. Work should be undertaken to demonstrate the enhanced profitability of the outcomes of such measures for potential investors. Summarizing, need for mechanisms to ensure compliance with national and international regulations/standards. This may also include process, product, and service certification.
- √ There is a need for regulations not only stipulating building regulations or information exchange standards, but also a certain degree of regulations/recommendations on key processes. The new guidelines for building information modelling by Senate Properties in Finland, and the National Building Information Model Standard of the USA are such examples. Building regulations and their meanings and adaptation in building project levels can be mentioned

further. For instance how to adapt energy efficiency regulations to a refurbishment project of cultural heritage. Exploring new approaches on the building process itself could also be suggested, allowing all construction players to suggest solutions, so the innovating power arises (the contractor can be aware of an innovation the architect isn't informed on).

4.2.3 Market Related Recommendations

One of the main movers and potential innovation shakers in the built environment is the public sector with large scale infrastructure projects, such as e.g. Roads, airports, drainage systems, schools or hospitals. All the players involved in the public sector, large construction companies working both nationally and internationally, large scale material suppliers, concrete, steel, large scale service companies, design project and facilities management, SME's involved in small scale construction, material supply and services, professional and craft knowledge workers, architects, civil engineers surveyors, planners,... each of these categories of players could become more innovative if there were changes in Public Sector tendering models.

Public sector contracts are of such a dimension that they offer the possibility of accelerating innovative products and services entry to the market. It has been estimated that 40% of the demand for construction works comes from the public sector (*European Commission 2007*).

- √ To encourage such a role public sector tendering conditions need to be changed from an unchanging legal prescriptive format to a more iterative process, which does not proscribe innovative solutions. Instead tendering specifications should be changed to specify government's need by reference to performance or functional requirements. Government departments and agencies should use an output specification and allow industry to apply new technology to their proposed solutions. The use of output specification contracts (performance based) would allow suppliers to continue to develop their product, would be likely to lead to lower costs and it is usually linked to better quality. Prescribing high levels of technical detail in the requirements, for example, usually prevents companies from submitting innovative proposals, as this type of contractual model allow no room to propose these. Clearly the specifications must be precise enough to permit the award of the contract in accordance with the rules governing the procedures.

It is worth to mention here the PeBBu Network that wants to stimulate a pro-active facilitation of international dissemination and implementation of Performance Based Building in building and construction practice:

<http://www.pebbu.nl/pebbuthematicnetwork/>

Careful thought would also have to be given to those tendering which can prove their technical ability, especially if they offer an innovative solution that might work differently from standard products. If the authorities do not give contractors the

freedom to supply innovative solutions, there is no way the market will be able to serve their needs in the best possible manner. Public sector agencies should consider utilizing qualitative award criteria to foster innovation, it is important to be clear on how to evaluate proposals against these criteria, such as price - liability and warranties. Incentives could be stipulated in a contract to provide the contracting authority with, for example, further innovative improvements. Contracting Authorities could benefit from these improvements as long as they are stipulated in advance in the invitation to tender, and are equal to all potential bidders. There is a need for a holistic perspective to ensure benefits to users of buildings. The impacts of new technologies on users need to be appropriately addressed.

- √ It is also important to host newly created companies during the first years of their life. There are several incubators delivering services to Biotech and ITC firms but none focuses on sustainable construction. Showing public actors that sustainable construction as a lead market has a potential for high growth, may modify the public approach and contribute to the creation of incubators hosting sustainable construction companies and “clean-tech” firms.

4.2.4 Administrative/Institutional Related Recommendations

From an administrative and institutional point of view, we give the following policy recommendations:

- √ Public sector research has been dominated by emergent activities (Bio, Nano, ICT, etc.) to the neglect of the built environment. There is a need for national and international level policies supporting the evolution of the construction sector. Initiatives such as the Strategic Research Agenda and Implementation Action Plan of the European Construction Technology Platform should be supported at national and international levels. At the same time, to ensure satisfaction of national needs, national policies are required. These should however be in line with international policies and fit into the "bigger" picture.
- √ Strategic roadmaps for the construction sector should not only be developed, but serve as a basis for evolution of national priorities in terms of public financing for new innovations. All parties of innovation chain should be involved: basic education, universities, research institutes, industry parties, funding agencies, innovation policy makers, ministries, etc... Such understanding that investing into basic education is a good seed element to foster global competitiveness by enhancing the innovation ratio is universally shared (European Commission 2006, OECD 2006) and applies also for all construction related issues. In general, soft skills have become more and more a hard tool in innovation policy (Audretsch 2002, 2007, Science Business 2007). The Commission needs to encourage member States to create R and D training systems where such supports are absent and to encourage some way of standard consistency in the European Commission.

- √ There exists a need to provide a harmonised regulatory environment across the EU favourable to innovation and based on early anticipation of needs that sufficiently takes into account new technological and market developments in the Built Environment sector. This would aim to reduce transactional costs, to increase market access and thus diminish perceived investment risk, making the sector more attractive to investors. Moves to adapt the regulatory framework would be more effective if such an approach were to be developed in close cooperation with the Member States, in the same way as the “Action programme for reducing administrative burdens in the EU” outlines how the Commission intends to work with Member States to cut administrative burdens on businesses by a quarter by 2012.
- √ The Commission needs to develop an easy access low cost uniform supportive intellectual property protection environment. Where innovative goods are developed in the construction sector, intellectual property rights may arise and an IPR policy then becomes essential. It is useful to decide how best to handle IPR and who should be the holder. If government decides to keep the IPR, it will have to pay the price for exclusive development, as the supplier can not re-use IPR. A supplier who can keep the IPR may consider it to be an investment, a building block for other projects. This would normally be reflected in a lower price for the purchaser.
- √ There is a need to examine IPR policies in Public contracts and the issues widely disseminated to all parties including Venture Capitalists. A possible way forward would be to follow the example of the entry into force of the Geneva Act of the Hague Agreement concerning the international registration of industrial designs, in respect of the European Community. From 1 January 2008, this act allows companies, with a single application, to obtain protection of a design not only throughout the EU with the Community Design, but also in the countries which are members of the Geneva Act of the Hague Agreement concerning the international registration of industrial designs.
- √ Clusters of stakeholders need to be set-up to include all stakeholders before new policies are set. Note that the users define what they would like to have and why. Developers will provide the how, and be supported by innovation financing to be able to meet user wishes. These user wishes should be in line with national policies that support for example energy efficiency, facility modularisation, on-demand configurable spaces and facilities. Culture of innovation in the companies as well as the elements of the functional innovation environment must be developed and cherished. This area overlaps with the issue of societal recommendations. Discussion has increasingly acknowledged to combine thought on innovation with regional clusters (Rehfeld 2005) and to integrate the issues with information capacities, product creation, opportunity finding processes and specific regional conditions (Asheim et al. 2006, Asheim und Coenen 2005). The whole process can be integrated by coaching regional policies trying to embed and to foster networking processes of businesses. The same is valid for the development of the

sustainable construction lead market which also requires coordination between innovation, industry, energy, housing, economic and environment governmental areas.

4.2.5 Societal Recommendations

According to Shane (2003) opportunities are created not only by single entrepreneurs but they are pulled and offered by societal changes. A global “greening of society” in terms of an increasing awareness for issues of sustainability during the last 25 years indicate that “opportunities for improvement are huge” and “market forces alone won't realize them” (Farrell et al. 2007).

In other words, global changes in combination with changing life-styles and consumer behaviour in favour of energy saving act as innovation catalyst which should be supported by:

- √ Sustainable performance based standards.
- √ A legislation more oriented to facilitate deployment of eco-innovative solutions.
- √ New fiscal instruments that really take into account the life-cycle costs and consumptions of the buildings.
- √ The introduction also of life-cycle and cost-benefit assessments in the public procurement contracts, considering also possibilities as PPPs, FTCs, etc.

It must also be acknowledged that the very encompassing market area of sustainable construction is heterogeneous and involves environmental concerns (e.g. efficient electrical appliances and heating installations), users' health aspects (e.g. in-door air quality) and issues of convenience (e.g. related to elderly persons' independence). It encompasses developing sustainable solutions for residential and non-residential buildings as well as in infrastructure assets (*European Commission 2007*).

Finally, there is also a point of educating potential or new entrepreneurs: Entrepreneurs usually have a technical background. But most of them do not have a business culture. They discover the expectations of the financial world little by little. Providing them with the appropriate training during the first year of the creation of the new firm would probably help them to take better decisions sooner.

4.3 Policy Recommendations by type of agent

In this chapter we try to make a summary of many of the findings and conclusions reached in Build-Nova. Which financing instruments are (successfully) in place? Which are missing? Which measures should particularly be encouraged and why?

- Instruments already in place: public procurement, public private partnerships (PPPs), fixed term contracts (FTCs) by public administration. They all have proved successful for the promotion and construction of social infrastructures and buildings.
- Financing instruments missing: innovation oriented public procurement, PPPs and FTCs, which take into account and reward the innovative characteristics of the new projects. Also national research programs specific for the construction sector (they exist in countries like France, Spain and Finland, but not in others like Ireland, Poland...). Here and compared with other sectors, the missing instruments are private seed and venture capital, disappeared from the map in most of the countries.
- Specific measures: There is a need for interaction between construction companies (components providers especially but also the partners involved in the conception- and construction process) and private investors, and of course a need for a new lead market which could bring them together in the basis of new emerging business possibilities, as the sustainable construction. There is also a need for dialogue and reflection between construction representatives and public administrations, in order to adapt the building contracts to the new sustainable and efficient solutions (PPPs, FTCs, etc.) *The national construction platforms or specific clusters for construction companies could help in providing this kind of communication channels.* Finally there is a need to create and deploy funding and innovation programs specific for construction, at European, national and regional levels.

All what Build-Nova has learned to know through its international comparative European research on innovation in European construction markets is manifold and very detailed. However, it can be summarized for different stakeholders:

- ***Recommendations for the governments, as legislators, clients and promoters as well:***

De-Regulate as much as possible the sector, allowing more space to innovative (and eco-innovative) solutions in construction while assuring safety and durability of the buildings and infrastructures. Examples are many obligations which hinder deployment of modern innovative solutions as prefabricated components, real time evaluation of concrete solidification, etc.

Develop performance based standards (imitating the energy efficiency models) and improve the process of changing these standards, as at present it's a very time consuming task. The lack of consistency in standards in the EU proves to be a

problem which needs to be addressed as a block of innovation since it impedes the ability of companies to access the market.

Introduce innovation and sustainability (life cycle based) criteria when assessing the public procurement tenders for social and public buildings and infrastructure.

Put in place specific research and innovation programmes for construction, as this is a key sector for the achievement of the European sustainability objectives. Include participation of promoters, contractors and architects as mandatory for a project to be eligible.

Facilitate the creation of new incubating services capable of hosting sustainable construction companies and “clean-tech” firms.

Provide a harmonised regulatory environment across the EU favourable to innovation and based on early anticipation of needs that sufficiently takes into account new technological and market developments in the Built Environment sector.

- ***Recommendation for construction companies and investors***

Include promotion of innovation among the top priorities of the construction associations and technology platforms, with the objective of achieving the cultural change necessary to make construction attractive to investors.

Develop business fora where innovative construction companies (component providers) and investors can interact, have dialogue and explore new business opportunities coming from example from the sustainable construction lead market

Facilitate public and private financing of emerging technologies which can support the development of new solutions and concepts in the building and construction sector.

- ***Is there a need to coordinate with other policy areas?***

Development of the sustainable construction lead market requires coordination between innovation, industry, energy, housing, economic and environment governmental areas, with a need to develop:

- Sustainable performance based standards
- Legislation more oriented to facilitate deployment of eco-innovative solutions.
- New fiscal instruments that really take into account the life-cycle costs and consumptions of the buildings.
- The introduction also of life-cycle and cost-benefit assessments in the public procurement contracts, considering also possibilities as PPPs, FTCs, etc.

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