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Developing Intelligent Regulation in Denmark

How intelligent regulation can become an active element in Danish innovation policy

- Based on cases from the Danish construction sector

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Summary

Like many other countries, Denmark is facing significant challenges to growth and innovation. Across the globe, we are witnessing a growing focus on the public sector as a driver of innovation.

According to the OECD and the European Commission, the public sector is a potential key driver of innovation. The purpose of intelligent regulation is to meet societal challenges while promoting growth and innovation across the business community at the same time. While intelligent regulation has gained more awareness in countries like the United States, Finland and the UK, information about actual lessons learned in the field of intelligent regulation is scarce.

Denmark has little experience in the field of intelligent regulation. This report is by all accounts the first comprehensive Danish analysis of intelligent regulation – in this case the construction sector. The purpose of the analysis is to identify the effect of new regulation on business innovation and to provide input for how intelligent regulation can become an active part of Denmark's innovation policy.

This analysis shows that recent regulation in the construction sector has indeed addressed societal challenges while at the same time positively affecting innovation. A wide range of companies have introduced new products, materials and processes or have improved existing products as a result of new regulations. In other cases, companies have entered new markets as pioneers in developing products and solutions to meet specific requirements, which have subsequently been implemented in other countries. Finally, new regulations have provided companies with access to other business sectors and multidisciplinary collaboration.

Performance-based fire requirements are an example of a new type of regulation that has impacted innovation. Performance-based requirements do not dictate concrete solutions as did previous requirements arising from detailed regulations. Performance-based requirements give architects, engineers and manufacturers better opportunities to develop and apply innovative solutions. This has resulted in innovative new architecture that was not possible under the old regime of detailed-regulations.

The actual shaping of intelligent regulation is a much more complex process compared to traditional regulation and poses a number of dilemmas for lawmakers.

For instance, some countries may be more motivated to adopt stringent environmental regulations to brand themselves as being environmentally aware. At the same time, stringent and ambitious environmental legislation can help national sectors to develop international positions of strength. One should consider which industries are impacted by the regulation, however. If the affected sectors are dominated by a few large companies and an abundance of small companies there is a risk the requirements will only benefit the leading manufacturers and leave out the small ones. This could potentially create a monopolistic environment, inhibit competition and raise consumer prices. It is also conceivable that a situation could be created where national companies are outcompeted by foreign competitors.

Based on the report's findings, we have identified a number of key areas that can be taken into consideration when public authorities formulate intelligent regulation.

1. *Systematic inclusion of markets and experts:* public authorities must work together with the private sector, trade organizations and experts to discuss how intelligent regulation can support the development of innovative solutions.

2. *Intelligent regulation cannot stand alone:* it is important to regard intelligent regulation as one of several tools that must be supported by other initiatives, such as public procurement.

3. *Formulate intelligent regulation in areas where there are national positions of strength:* these areas will comprise competitive companies and specialized knowledge institutions with the expertise to develop new solutions and to engage in dialogue with the relevant public authorities.

4. *Dynamic approach:* assess and adjust regulation continuously to maintain a competitive gap vis-à-vis other countries.

5. *Competence development in the public sector.* using intelligent regulation will often require the development of competences within the public sector.

6. *The shaping of intelligent regulation should be founded on general principles.* 1) *performance-based requirements:* replace detailed regulations wherever possible by performance-based requirements; 2) *ambitious targets:* when formulating ambitious targets, make sure they can be achieved within a realistic time frame; and 3) *time for innovation:* make sure intelligent regulation allows for time to innovate.

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1. Introduction

1.1 A new rationale for innovation policy

Like a host of other countries, Denmark faces significant societal challenges in the areas of climate change and welfare, among others. These challenges are gaining increasing focus when addressing innovation policy.

Around the world, we are witnessing the public sector taking on a more proactive role as a driver of innovation in the private market via, for example, a more strategic use of public procurement, regulation and standards.

The OECD¹ and the EU Commission² emphasize the critical role of the public sector as a driver of innovation in their most recent innovation strategies (*Getting a Head Start on Tomorrow* and *Europe 2020 Strategy*), in particular through stronger demand for innovative products and the use of regulation.

Several countries already focus on intelligent regulation, i.e. regulation that supports societal goals (the environment, safety regulation, health, etc.), while maintaining a strong focus on growth and innovation in the business community. In the construction industry, there is strong international focus on tightening energy requirements for new buildings. In this way, regulation promotes the dissemination of existing and more environmentally-friendly solutions and supports the development of entirely new solutions. This is explained in more detail in the box below.

¹ OECD: "Getting a Head Start on Tomorrow", 2010.

² EU: "Europe 2020 Strategy", 2010.

Box 1.1 Example of intelligent regulation

A number of countries are about to tighten energy regulation as a result of the new revised Building Directive (2010/31/EU), which stipulates that all new buildings must be “nearly zero-energy” by 31 December 2020. Government buildings should meet the “nearly zero-energy” requirement by 31 December 2018.

Most countries are well under way in organizing plans and setting goals for the introduction of the “nearly zero” energy frame and have introduced plans or strategies for tightening energy frame requirements before 2020.

The Netherlands has implemented regulations calling for all public buildings to be energy neutral by proposing that all new buildings are energy-neutral by 2020. In Germany new buildings erected in 2012 and 2013 are to use 30 percent less energy compared to the 2009 requirements. Germany has also proposed that all new buildings be energy-neutral by 2020.

Both countries expect these requirements to result in higher innovation activity in the private sector leading up to 2020.

Although international lessons learned in the area of intelligent regulation are still limited, a number of countries have launched several initiatives to shed light on this area.

Finland is actively pursuing a strategy of demand-driven innovation in its 2010 innovation action plan.³ It focuses on the role of the public sector in promoting innovation in the private sector through the strategic use of public demand and regulation.

In terms of regulation, knowledge about the impact of regulation on corporate innovation is being compiled, including which type of regulation promotes innovation most effectively. Specifically, a number of examples of environmental legislation in Finland are selected. Their impact on company innovation is then assessed for the purpose of drafting forward-looking recommendations.

In the UK, the Ministry for Trade and Industry has been collaborating with national business organizations since 2008 to identify possible flaws in current regulations that may hamper innovation. New opportunities for promoting innovation via new regulation are also identified.⁴

A number of guiding principles for innovation-friendly regulation are drafted. Moreover, we find examples of stakeholders engaging in dialogue to ensure that innovation is addressed at very early stages when formulating new regulation.⁵

The Danish Business Strategy on Climate Change from 2009 formulates a regulation code for the climate and environmental areas.⁶ The code comprises eight guiding principles for regulation.⁷

Moreover, the government’s innovation strategy from 2010⁸ focuses on regulation as a tool

³ Finnish Ministry of Employment and the Economy: “Demand and User-driven Innovation”, 2010.

⁴ “Regulation and Innovation: evidence and policy implications”, BERR, 2008.

⁵ See <http://www.innovateuk.org/>

⁶ Danish Ministry of Economic and Business Affairs, “Business Climate Strategy”, 2009.

⁷ The principles include a focus on partnership access, outreach, effect measures and technology-neutral timing, clear communication and long term initiatives, coherent regulation and, mandatory minimum standards combined with incentives, and competition.

⁸ The Danish Government, “A Business-Focused Innovation Strategy”, 2010.

for promoting innovation. The present analysis was carried out to formulate a number of recommendations for a more systematic approach to introducing intelligent regulation.

1.2 What is intelligent regulation?

In this report, intelligent regulation is defined as “*legislation that supports societal goals (the environment, climatic change, safety, health, etc.) while maintaining a focus on creating growth and innovation in the business community*”.

Below, we highlight a number of characteristics of intelligent regulation that have been identified in our analytical efforts or international literature.⁹

Intelligent regulation typically has a long-term perspective and formulates ambitious goals that are to be accomplished sometime in the future. In Denmark, for example, it has been decided that energy consumption in new buildings be reduced by at least 25 percent in 2010, 50 percent by 2015 and 75 percent by 2020.

These ambitious goals will leave it up to the market to develop new, innovative and cost-efficient solutions that will make it possible to meet these predefined goals. The lengthy time frame will give companies time to plan and organize product development, develop new services and organize production changes to avoid any unnecessary costs.

Using intelligent regulation, legislators will typically take a proactive approach where new regulation will mandate new technology and new and improved products to meet the regulatory standards. Traditional regulation is usually based on a reactive principle where legislators await the development of new technology and then adapt regulation to its capabilities.

Intelligent regulation gives companies more leverage for developing new solutions. Previously, Danish building regulations were dominated by detailed requirements that dictated specific solutions, the use of certain building materials, etc. These have been replaced by performance-based requirements which provide more flexibility for designing and laying out a building. One such example are performance-based fire requirements which were introduced in 2004 to replace the existing detailed regulations.¹⁰

Another example is the 2006 energy performance of new houses that represents a paradigm shift from individual detailed requirements to performance-based requirements relating to a building’s overall energy efficiency.¹¹

Will regulation inhibit or stimulate innovation?

Traditionally, new regulation has been perceived as imposing additional costs on companies affected by the regulation and that, therefore, new regulation inhibits company growth and innovation. If legislators introduce tighter technology standards, emission standards or taxes, companies incur additional costs to develop new products that meet these new regu-

⁹ “Regulation and Innovation: evidence and policy implications”, BERR, 2008; “The Importance of Regulation-Induced Innovation for Sustainable Development”, Ashford, 2011; and “Designing Smart Regulation”, Gunningham, 1998.

¹⁰ This led to the following change: “There should be stairs for every 50 metres, with doors that are least 0.74 metres wide, landings that are at least 1.3 metres and staircases that are at least 1 metre” was changed to: “A building should be designed and constructed in such a manner that evacuation can take place via escape routes or directly to the open air or to a another safe area of the building”.

¹¹ Prior to the introduction of the energy frame calculations, a heat loss framework and a net energy framework were used, see, e.g., Ea Energianalyse A/S et al., 2008.

lations – costs that could otherwise have been spent on the company's core business.

Some have challenged this viewpoint by arguing that new regulation could actually stimulate innovation and growth.

US economist Michael Porter has argued that regulation may prove advantageous for companies facing tighter technology standards, emission standards or taxes.¹²

One argument is that companies adapt to the new situation by economizing on their use of materials, introducing new technology and developing new or improved products. After a transitional period, the companies affected by the regulation have a competitive advantage vis-à-vis companies in countries that are subsequently expected to introduce similar regulatory standards. As a result, regulation is beneficial for societal considerations and corporate profits alike.

In the field of economics, these two approaches have been subject to some debate. Obviously, the correlation between regulation and innovation is complex and companies can experience both positive and negative effects from regulation. Regulatory changes interact with a number of market-dictated conditions market and various policy measures, and it can therefore be difficult to isolate the effects of regulation on innovation.¹³ The correlation between regulation and innovation can go both ways: regulation can stimulate the development of new technologies, but new technologies can also help to create market opportunities and market failures that require changes in the regulatory framework.

The conclusion is that increasing the use of intelligent regulation will challenge the drafting, implementation and enforcement of the regulation.

¹² Porter, "The Competitive Advantage of Nations" 1991; Porter and van der Linde, "The Porter Hypothesis", 1995

¹³ Aghion, P., Bloom, N., Blundell, R., Griffith, R. and Howitt, P, 2002, "Competition and Innovation: An inverted U relationship", Jaffe 1995, Gray & Shadbegian 2002, 2003, Wagner 2003, Pizer & Kopp 2005.

1.3 This analysis

Although an awareness of intelligent regulation has been given higher priority on political agendas all over the world, the lessons learned from it are still limited. The purpose of this analysis is to boost the level of knowledge in this area. The analysis will also contribute to the ongoing intelligent regulation debate and may serve to inspire politicians and legislators.

The systematic use of regulation to support innovation is a relatively new exercise. Can public considerations, societal challenges and innovation go hand in hand? To what extent can intelligent regulation actually contribute to overcoming larger societal challenges and stimulate more innovation at the same time? How should intelligent regulation be organized? To what extent will the public sector require various skills and knowledge in order to successfully use intelligent regulation? Which dilemmas will arise from this?

This analysis focuses on the construction sector, on the assumption that the tools needed to promote innovation through regulation are sector-specific to some extent. Moreover, the intelligent regulation debate in Denmark has so far taken place at a general level. Now there is a strong need for in-depth analysis of a particular area.

The construction sector has been selected for further analysis, as the Danish Enterprise and Construction Authority is responsible for regulation in the construction sector and therefore has extensive knowledge in this area.

While several attempts have been made to carry out quantitative efficiency analyses of regulation, the results are still ambiguous. Hence, the current analysis is based solely on qualitative studies to gain a better understanding of the effects, processes and mechanisms related to intelligent regulation.

The analysis clarifies the difference between traditional regulation and intelligent regulation and provides a number of examples of how regulation can affect corporate innovation activities. The analysis also focuses on the opportunities and challenges relating to the use of intelligent regulation as a policy tool for promoting innovation.

Moreover, the analysis introduces a number of considerations that should be taken into account when working with intelligent regulation.

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2. Intelligent regulation in the construction sector

2.1 Denmark's construction industry

In terms of employment, construction is the largest industry in Denmark. In 2008, construction accounted for 10 percent of the GDP (DKK 170 billion). Both in Denmark and abroad the construction sector is challenged by lagging productivity growth. Average productivity growth in the Danish construction sector was negative from 1990 to 2010, while productivity in general grew by about 1 percent annually.¹⁴

The Danish construction sector is less innovative compared to other sectors and only 11 percent of construction companies replied "yes" when asked if they had introduced a new product or service, compared to 44 percent of manufacturing companies. Moreover, construction companies allocate limited resources to new-product development.¹⁵

The lack of development in the construction industry is often reflected in the fragmented value chain, where each new building project contains many unique elements and many different partners. The developer, the contractor and various subcontractors have to collaborate on the building process. In addition, part of the construction industry is orientated towards the domestic market where building regulations vary from one country to the next. Technological and organizational knowledge presumably spreads across borders at a slower rate than in other business sectors. Finally, consumer preferences differ from one country to the next.

Increased innovation in the construction industry will therefore lead to significant socio-economic benefits. Intelligent regulation may be an important tool in this respect.

¹⁴ Source: Statistics Denmark, Statistical Bank, tables NAT01, NAT04.

¹⁵ CIS2006, calculations by DECA.

2.2 Regulation in the construction sector

Denmark's building legislation is comprised of a building act and a building code. The primary purpose of building legislation is to ensure that all buildings are safe to use and occupy.

All buildings must be safe in terms of fire, safety and health standards. Moreover, building legislation seeks to ensure the construction of new buildings with architectural quality to balance a building's appearance with its functional and constructive design in relation to the surroundings.

A growing number of performance-based requirements have been implemented in building regulation. Denmark was among the first countries to implement performance-based fire safety requirements. Denmark is still far ahead of its peers, including Germany, but specific trends in this area are still uncertain.

One of the aims of implementing performance-based requirements is to create greater flexibility in the design and layout of buildings and solutions. A certain degree of freedom in terms of functionality and design can be accomplished without compromising on primary considerations relating to safety, health, etc. As a result, the regulatory framework is basically based on functionality within the principal areas of the building code.¹⁶ Some areas have varying degrees of detailed requirements, while in others, regulation is dictated solely by detailed requirements.

The introduction of performance-based fire requirements (2004) and the energy performance of new buildings (2006) are examples of how detailed requirements are replaced by performance-based requirements. The (more or less deliberate) purpose was to allow for greater flexibility in the design and layout of buildings and solutions. We address both examples in this analysis and also look at the extent to which legislative changes have created a new or improved framework for corporate innovation activities.

Denmark's building regulations are primarily based on longer time perspectives, particularly in areas addressing various policy considerations. Goals are set early on, allowing the industry to develop products that achieve the ultimate goal. In other areas where the regulatory purpose involves safety or health, the time frame is much shorter, as immediate action is required. Thus, we see a trend where longer time frames are used solely in areas in which a future policy goal has been set.

In practical terms, Denmark's building regulations involve various stakeholders in areas that will ultimately achieve the policy goals. These players often possess significant and relevant knowledge. At the same time this ensures that new rules and requirements can be met by all parties.

The Danish construction industry is heavily regulated and similar trends are seen throughout most of the EU. The building-materials area, a subset of the entire construction industry, is characterized by a high degree of harmonization across the EU. This is reflected in mandatory requirements for building materials within the EU. These mandatory requirements are supplemented by a series of product testing standards. Other areas of building legislation are also influenced by European law. The EU has implemented a number of construction standards and these are referred to in Denmark's building legislation. When drafting new

¹⁶ Building interior, construction, fire safety measures, indoor climate, energy consumption and installations.

national requirements, legislators must also ensure not to create a conflict between national requirements and standards adopted by the EU.

2.3 Case studies

FORA, the Danish Enterprise and Construction Authority's division for research and analysis, has conducted seven case studies of recent public regulations to gain a better understanding of the impact, process and mechanisms relating to intelligent regulation.

The case studies were carried out in the area of building regulations, which is the remit of the Danish Enterprise and Construction Authority.

The case studies serve three overall purposes. Firstly, they serve as indicators of the effect of new public regulations on corporate innovation activities. Secondly, the studies provide information on challenges that need to be addressed when drafting regulation. Finally, the case studies provide insight into tangible policy opportunities as well as insight into the elements that are vital when designing intelligent regulation.

It should be emphasized that the actual design of intelligent regulation in the case studies was rarely driven by an explicit desire to stimulate innovation among the companies concerned.

The case studies were carried out in the area of building regulation. Hence, the recommendations put forward primarily focus on building legislation. Conversely, it is assessed that a number of the lessons learned and recommendations in the area of building legislation may be relevant to other regulatory areas.

2.4 Selected case studies: background

Legislators and building policy experts were asked to select a number of examples of building regulation that led to more innovation and economic growth in the companies concerned.

Legislators were also asked to cite examples of regulation that stimulated innovation to a minor extent as this will help to vary the discussion on intelligent regulation.

The following case studies were selected for further analysis:

Box 2.1 Performance-based fire requirements

In 2004, performance-based fire requirements were introduced to replace the existing detailed fire requirements. This meant that the actual wording of the Building Code was changed from “There should be stairs every 50 metres with doors that are at least 0.74 metres wide, landings that are at least 1.3 metres and staircases that are at least 1 metre” to “A building should be designed and constructed so evacuation can take place via escape routes or directly to the open air or to a another safe area of the building”.¹⁷ The purpose of introducing new performance-based requirements was to promote the development of new types of buildings by providing for more flexibility in the design and layout of a new building without compromising on fire safety. At the same time it was important to establish a set of rules that considered the complexity of erecting new buildings.

¹⁷ Building Code 2008, DECA.

Box 2.2 Energy performance of new buildings – lighting, ventilation and window manufacturers

The introduction of the energy performance of new buildings represents a paradigm shift by replacing detailed requirements for individual elements with performance-based requirements relating to a building's overall energy efficiency.¹⁸ By introducing the energy performance of new buildings, Denmark became one of the first EU countries to implement the EU Directive regarding energy-efficient buildings. The introduction of the energy performance of new buildings was driven by the wish to provide builders, architects, etc., with greater manoeuvrability in selecting technologies, building materials and solutions that would most effectively comply with the requirements for greater energy efficiency in new buildings.¹⁹ Therefore the goal was to reduce energy consumption in building maintenance, while leaving it up to the market – developers and consultants – to decide on the most effective measures for improving energy efficiency. Detailed requirements still exist in some areas and have different impacts on construction subsectors. Therefore, we have selected three subsectors – lighting, ventilation and window manufacturers – for further analysis of how the requirements of the energy framework impact selected subsectors of the construction industry.

Box 2.3 Accessibility

The general aim of accessibility regulations is to provide equal access to all buildings and to the use of various facilities, etc. In this respect, current accessibility planning basically assumes that persons with a disability are capable of helping themselves wherever possible. In the area of building regulations the number of performance-based requirements has generally been increasing. One reason for implementing performance-based requirements is to provide greater flexibility in the design and layout of buildings and solutions. In so doing, a certain degree of freedom in terms of functionality and design can be achieved without having to compromise on safety, health, etc. In the area of accessibility, this trend has been the opposite. Basically, regulations in this area are performance-based, but the degree of detailed regulations has been growing over the years. One example of this are requirements relating to the layout of toilets for the disabled. In the 2010 Building Code, the 1995 guidance became part of the requirement, and accessibility requirements were tightened compared to the 1995 Building Code.

¹⁸ Prior to the introduction of the energy framework, calculations focused on a heat-loss framework and a net-energy framework. See, e.g., Ea Energianalyse A/S et al., 2008.

¹⁹ Jerking and Aggerholm, "Tighter energy requirements in the Building Code" 2005.

Box 2.4 Biomass boilers

Denmark and most other European countries have two types of requirements to biomass boilers. The first focuses on the boilers' net output in converting biomass into heat. The second area focuses on the emission of hazardous substances, including dust particles, etc. Boilers must generally stay below a number of predefined values set by public authorities. The 2010 Building Code (BR10) states that boilers must have a 75 percent efficiency rate and comply with Boiler Class 3 of the European EN303-5 standard. This is unchanged compared to BR08 and the Danish requirements are more lenient compared to some other European countries, including Austria. The reason for not introducing stricter regulations is that Denmark is currently awaiting the results of a revision of international standards.

Box 2.5 ISO 9001 – Quality Management Systems

ISO 9001 – Quality Management Systems is a collection of standards for management systems. ISO 9000 is governed by ISO,²⁰ whereas national accreditation and certification agencies certify and issue the ISO 9001 certificate to the commissioning company. ISO requirements encompass a range of procedures covering key processes, process monitoring, error controls and the introduction of procedures to minimize errors. ISO 9001 is not a permanent certification but must be renewed every three years. To renew its certification, the company must document that it still meets the formulated goals and document that the company is continuously improving its standards to meet the ISO requirements. 1,500 Danish companies are ISO 9001 certified.

The case studies are based on approximately 70 interviews, 10 per case.

Interviews were carried out with civil servants involved in the implementation and/or administration of the actual legislation. We also conducted a series of interviews with companies affected by legislation and key interest organizations representing a broad group of companies. Finally, interviews were carried out among key interest organizations representing specific needs, including disabled peoples' organizations in the case concerning accessibility requirements.

²⁰ International Organization for Standardization: <http://www.iso.org/iso/home.html>.

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3. Impact of regulation on innovation

A primary goal of this analysis is to identify the extent to which the implementation of new regulation has led to increased growth and innovation among the companies affected.

Therefore, the interviewed companies were asked to assess the overall effects of new regulation, including the extent to which they developed new products and services as a result of new regulation and how new regulation has impacted their access to international markets.

The analysis shows that new regulation has indeed addressed societal challenges while at the same time encouraged innovation in many of the companies affected by regulation. Thus, most companies have:

- introduced new products, material and processes;
- gained access to new international markets;
- gained access to the construction sector; and
- engaged in new multidisciplinary collaboration.

The box below outlines the types of effects predominant among the companies interviewed for the individual case studies.

Box 3.1 Various types of effects among interviewed companies

	Product- or process innovation	Access to new international markets	Access to the construction industry for established companies from other sectors	New multidisciplinary collaborations
Performance based fire requirements	X	X	X	X
The Energy Performance of new buildings - Windows	X	X	X	X
The Energy Performance of new buildings - lighting	X	X		
The Energy Performance of new buildings - ventilation	X	X		
Accessibility	X			
Biomass boilers	X			
ISO 9001 – Quality Management Systems	X			

3.1 Product or process innovation

The interviews produced a number of examples of product or process innovation that emerged as a result of new regulation.

The analysis cites examples of companies that have introduced new products in the domestic market; where the products are assessed as being driven by performance-based requirements. For companies heavily involved in exports, the regulation gave a boost to the innovation of new products. There are also a number of examples of improvements of existing products and solutions, including new product designs, new materials, etc.

Companies in the window industry state that the stricter energy performance of new buildings has led to a striking shift in the development of new windows. Whereas previously companies focused solely on a window's ability to reduce heat loss (U factor), today much broader requirements are imposed on a window's overall energy performance.

This has made it necessary to develop brand-new types of windows to meet the requirements for combined energy performance. The industry argues that performance-based energy requirements have prompted the introduction of new products. As Danish companies are leading the international market for energy efficient windows, the industry clearly expects performance-based energy requirements to strikingly increase exports in the years ahead.

Box 3.2 Protec 7 and Helo

In 2007, a new energy-efficient window "Protec 7" was developed by the company Protec in response to the energy performance of new buildings. Instead of using wood and aluminium, the frame is made of a fibre composite with higher insulating capabilities, while maintaining the inherent strengths of wood and aluminium in terms of condensation and durability. The fibre-composite windows make it possible to build large glass frames within the requirements of the new energy framework.

Another example of a new energy-efficient window is "Helo" by VELFAC, developed in part as a result of performance-based energy regulation. The window was launched in October 2010 after extensive testing at several lab sites, including the Green Lighthouse. The windows are classified as plus-energy windows, i.e. the inflow of heat is higher than the heat loss during the heating season.

Companies in the lighting industry assess that the stricter energy performance of new buildings and expectations of increasing demand for energy-efficient lighting have greatly increased the potential for development. This is particularly evident in creating the lighting fixtures of tomorrow that are designed and optimized in accordance with LED (Light Emitting Diode) technology. An LED is a small electronic semiconductor which converts electric energy into visible light.²¹ Current focus is aspects like improving the design, developing reflectors, optimizing light quality, etc. Danish companies such as Louis Poulsen and Riegens are international frontrunners in this category. Danish light fixture manufacturers generally have a longstanding tradition for developing lighting fixtures that combine high light intensity with a continuing high quality of light.²²

²¹ Further reading: <http://www.leddisplay.dk/da/LED-teknologi.aspx>.

²² Interview with Willy Goldby, FABA.

The introduction of new performance-based fire requirements has also led to a number of innovations. Several interviewees pointed out how they could erect a number of spectacular new buildings using the new performance-based fire requirements, buildings that would not have been permitted under the previous fire regulation regime. These buildings and solutions are in demand around the world and have therefore resulted in international projects in countries that have subsequently introduced performance-based fire requirements.

This has led to a demand for Danish expertise in the area. The Fields shopping centre, Parken's retractable roof, Copenhagen Towers and Bella Center are highlighted as solutions that would not have been permitted under the previous detailed regulations.²³

Performance-based fire requirements have also led to the development of a wide range of technical installations that permit the use of flammable material if a technical installation is installed at the same time. New types of sprinklers, overpressure in staircases, new fire escalators and fire ventilation are examples of technical installations resulting from performance-based fire regulations.

3.2 Access to new international markets

In some cases, national requirements are stricter than European and other international standards, which gives Danish companies, products and solutions a competitive edge over other countries.

Stricter national standards also ensure that Danish companies will meet international requirements in the long term. Moreover, the introduction of performance-based requirements to replace detailed requirements will increase the demand for Danish experiences, but only if Denmark continues to lead the way in introducing performance-based requirements.

In the lighting industry, companies also assess that the energy performance of new buildings will increase the access to new international markets. Traditional retail and wholesale companies play an increasingly important role in using new energy-efficient alternatives. Wholesale companies will often combine energy-efficient components into coherent concepts to optimize the functional interaction of the individual components. At the same time, wholesale companies are increasingly offering skills enhancement in energy-efficient lighting to ensure that electricians and consultants have the skills required for providing advice on and installing the new advanced solutions.

²³ See <http://www.copenhagentowers.dk>.

Box 3.3 Solar

Solar is a prime example of a Danish company that built up an international position of strength by developing coherent energy-efficient lighting concepts combined with technical assistance and training. The strong commitment to concepts and training is highly driven by prospects of stricter energy requirements in the future. The company's focus on creating powerful product and service concepts has significantly contributed to the company's strong position in international markets.

Consulting engineering firms currently offer specialized consultancy in lighting and are also increasingly engaged in projects abroad.

In the ventilation industry, the interviewed companies state that ventilation standards have been instrumental to the companies' success in international markets. They have to be first-movers, not only in order to meet the requirements but also to ensure their own long-term survival. There is a gradually increasing growing focus on energy-efficient ventilation abroad, which has opened up new opportunities for companies like Novenco, which is pursuing new opportunities in Russia and the Middle East. The combination of a keener focus on energy efficiency and the ability of Danish ventilation companies to deliver highly efficient ventilation solutions has paved the way to new markets.

The introduction of performance-based fire requirements has also led to breakthroughs in countries that subsequently implemented the new standards.

Box 3.4 Velux

An example of this is Velux. Previously, Denmark and other European countries were bound by product-specific requirements that varied from one country to the next. Window manufacturers like Velux therefore had to build different products for different markets, which was hardly cost-efficient when marketing products to different countries simultaneously. As a direct result of the introduction of performance-based fire requirements in Denmark – and subsequently across most European countries – a common standard for windows was implemented.

3.3 Access to the construction industry for established companies from other sectors

In some cases new regulation can open up new markets for companies from other sectors. This is the case in the construction industry. This leads to stiffer competition and impacts productivity and ultimately growth and prosperity in the industry and society as a whole.

Intelligent regulation challenges the ultimate aims and not the capability of specific technologies. This provides opportunities for companies from other sectors to enter the construction industry's market; all that is required is that they are capable of developing new technologies or solutions to meet the ultimate aims, such as energy efficiency.

One such example are performance-based fire requirements which have opened up for the use of new material and solutions that were previously banned by detailed regulations. Companies that do not usually deliver goods and services to the construction industry now have the opportunity to do so.

A number of interviewees pointed out that performance-based fire requirements led to the creation of a new niche for consulting engineers. This was driven in part by the requirement for documentation related to "unconventional" solutions, where fire safety has to be documented using performance-based analysis and fire-technical calculations for determining things like the spread of heat and smoke or the effect of fireproofing systems and evacuation times. This knowledge has created jobs in countries which have subsequently implemented performance-based fire requirements.

Box 3.5 Fiberline

Fiberline entered the building materials market as a direct consequence of performance-based fire requirements. The company produces plastic-composite frames: hardened plastic reinforced with fibreglass threads. Plastic-composite has several advantages compared to traditional building materials: it is lighter, does not rust or rot, is not magnetic or electric and has a high insulation factor. Fiberline is planning to extend the use of the material to new areas, and the introduction of performance-based requirements has made it possible to use plastic-composite as a building material. The Holy Cross Church in Jyllinge is one example. The previous fire regulations did not permit the church to be built using plastic-composite. The composite material allows light to penetrate without being transparent. The cladding material is the same regardless of whether it is used for roofs or facades, and identical materials are used to achieve a consistent, harmonious style.

Another example is found in the energy performance of new buildings where plastic-composite offers significant advantages as a window frame material due to its excellent insulation capabilities, flexibility and durability, all of which are important to manufacturing frames. Several window manufacturers have embraced this material and use it instead of wood or aluminium. As a result of the energy framework for new buildings, Fiberline has been able to use the material in a brand-new way. This was not possible previously due to the lack of focus on frame materials that could increase a window's insulation capacity.

Finally, a number of lighting manufacturers single out the maintenance and technological upgrade of lighting fixtures in schools, institutions and offices as another growth area. These maintenance tasks will be a key part of future facilities management and is an area where a number of Danish service providers are strongly positioned – also abroad. One such company is ISS, a global services provider.

3.4 New multidisciplinary collaboration

As a result of the energy performance of new buildings, individual building components should to a greater extent be envisioned as part of a whole. In order to be capable of envisioning and comparing building components in a combined energy framework, the construction industry – including manufacturers, architects and engineers – should intensify their collaboration. There is a need to use integrated design, i.e. to develop new products by having manufacturers, architects and engineers enter into new types of collaboration. Moreover, new research collaboration will emerge in response to the need for developing a stronger knowledge base in the construction industry.

The energy performance of new buildings also pressures companies to develop new products and solutions that meet new and stricter regulations. This is particularly challenging to small companies with limited R&D resources, as they will find it difficult to rely solely on developing new products and solutions. Their success will hinge on being able to collaborate with other companies and knowledge institutions to meet the provisions of the energy framework for new buildings.

Among window manufacturers there are several examples of how the stringent requirements of the energy performance of new buildings have necessitated stronger collaboration across the value chain to develop new products and solutions that meet these stricter requirements.

Box 3.6 Living Lab

Living Lab by Dovista is an example of a window manufacturer that has taken the initiative to enter into new collaborative efforts. Dovista is part of the VKR Group and the parent company for VELFAC, Rationel, and several large Swedish plants. The energy performance of new buildings has made it challenging for window manufacturers to be able to provide advice on the use of the new windows. Dovista created the framework for engaging in dialogue and working together with architects and consulting engineers. The purpose of this exercise is to convey knowledge about VELFAC products to optimize the energy performance of new buildings.

A range of EUDP projects²⁴ focus on knowledge collaboration between manufacturing industries and leading Danish window-and-energy knowledge institutions (the Danish Technological Institute and the Technical University of Denmark). They are keenly focused on public-private partnerships, international cooperation, new energy-efficient technology projects and, in particular, disseminating the results of energy-technology projects.

The ventilation industry has a longstanding tradition for working closely with research institutions, etc. This applies to the actual development of products and solutions, but also to analyzing ventilation requirements in terms of being able to achieve a healthy indoor climate. In particular, the energy performance of new buildings stipulation that mechanical ventilation must be used at schools, etc., has forced companies which have traditionally focused on natural ventilation to find new ways. This is true of Windowmaster for example,

²⁴ Energy Technology Development and Demonstration Programme which promotes new climate-friendly energy technology to increase the stability of supply and realize Denmark's commercial potential in the energy sector.

which has collaborated with traditional ventilation companies to deliver hybrid solutions that use both natural and mechanical ventilation to meet current standards.

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4. Dilemmas

The purpose of intelligent regulation is to meet societal considerations while ensuring that the regulation supports corporate innovation and growth at the same time.

Based on the case studies, we assess that intelligent regulation is a much more complicated process compared to traditional regulation – and that legislators face significant challenges in this area.

One reason for this is that intelligent regulation usually entails a longer time perspective, more uncertainty in terms of market and technology development, and more flexible legislative requirements.

These and other challenges are clearly indicated in the case studies. From them we have extracted out a number of examples of the dilemmas and barriers that arise from using intelligent regulation, and present them in the following. It is important to consider these dilemmas and barriers in the future when promoting innovation via new legislation.

The list is by no means exhaustive. On the other hand, the dilemmas highlighted below may also arise in other instances in other sectors where there is a wish to use regulation to promote innovation and growth. These dilemmas are also found in existing literature.²⁵

²⁵ "Regulation and Innovation: evidence and policy implications", BERR, 2008.

4.1 Should we always lead the way?

If Denmark is the first to implement tighter requirements and regulations, this creates a number of benefits for Danish companies, which can gain competitive advantages by being the first to develop products and solutions to meet these requirements.

In order for it to be financially attractive for companies to adapt to stricter or modified regulations, it is crucial that other countries follow suit and implement similar measures. As this can be very difficult to predict with certainty, it can also make some countries reluctant to implement such measures.

There is a tendency for many of our neighbouring countries to focus on stricter requirements for new buildings and also share the Danish view that stricter legislation stimulates companies to become more innovative and achieve international positions of strength. Therefore, it is essential to keep an eye on current practices and trends in potential export markets. If Denmark fails to be at the cutting edge and fails to take the most ambitious and proactive approach to future official requirements, there is a risk that international competitors will end up supplying the building materials and being in charge of future construction activities in Denmark. There are already examples of this, such as not being able to find competitive Danish suppliers of building materials (including windows) for passive houses, which had to be imported from Germany instead.

Denmark was one of the first EU member states to implement the EU Directive regarding energy-efficient buildings. Denmark has also implemented stricter national regulations in anticipation that the rest of the EU member states will follow suit eventually.

Both lighting and window manufacturers assess that being the first country to introduce an energy performance of new buildings and having the strictest regulations could help Danish companies to establish positions of strength in these areas. Lighting manufacturers and others state that the new energy framework has intensified the focus on innovation in the industry. Several companies have launched development projects which aim to develop the energy-efficient lighting systems of the future.

Window manufacturers also assess that a remarkable shift has occurred in the way windows are manufactured as a result of the energy performance of new buildings. The fact that Danish companies are leading the way in European and other international markets for energy efficient windows will undoubtedly create striking export growth.

The possibility of international marketability should be considered, however. There should be definite prospects of having an international market for Danish manufacturers which must comply with stricter regulations or new requirements. For instance, 80 percent of Denmark's window manufacturers' exports go to countries with a warmer climate than Denmark's. Therefore it does not make sense to impose requirements dealing solely with U factors, as these products will not be in great demand in countries with a warmer climate. Here, other needs have a high priority, such as cooling, ventilation, etc.

Yet there are also examples where it is advantageous *not* to always lead the way in implementing a given set of regulations.

Although Denmark was one of the first countries to introduce performance-based fire requirements, Denmark was also able to draw on the lessons learned by the earliest first-movers, including Sweden, New Zealand and Australia. This was beneficial for Denmark, as

the performance-based fire requirements created a need to develop specialized skills among consulting engineers, due to new rules requiring documentation – calculations, computer simulations, etc. – to get the approval of the Danish authorities for construction projects.

Denmark's consulting engineers did not have these competences when the set of requirements was first implemented in 2004, so it was beneficial for companies that they could draw on the resources of consulting engineers in Sweden, which had already implemented performance-based fire regulation and had amassed expertise among its consulting engineers for drafting the necessary documentation.

4.2 How far can we go?

As was the case above, some countries may be motivated to adopt the strictest possible rules to gain a special reputation in the area. At the same time strict and ambitious environmental policies help national sectors to develop international positions of strength.

There are several considerations worth contemplating to achieve the desired effect. For instance, it is important to determine which companies will be affected by new regulations and will therefore have to comply with stricter requirements. If a sector is dominated by a few large and many small companies, there is a risk that the requirements will only benefit the biggest and eliminate the smallest in the process, thereby creating a monopolistic situation. This would not be beneficial from an socio-economic viewpoint and would lead to more expensive products.

To some extent, this was an issue in the case involving the impact of the energy framework on window manufacturers in Denmark. The window industry comprises some 70 window manufacturers, the majority of which are very small. It was therefore challenging to get the small companies to take part in the development race as this requires resources and skills that these companies seldom have.

The window industry itself suggests that this challenge be overcome through collaborative efforts involving small window manufacturers and Danish knowledge institutions. A number of EUDP projects have already been launched to lay the groundwork for innovation and product development among large window manufacturers, an approach that could easily be applied to small manufacturers as well.

It is also possible to envision a situation where no company in the national sector concerned can live up to the stricter regulations. This could have a positive impact on Danish manufacturers where foreign manufacturers force their Danish competitors to develop new products and solutions to keep their market share. But it could also create a situation where national manufacturers are driven out of the market by international competitors with the technology and ability to deliver products that meet the new standards.

4.3 Timing

When contemplating the implementation of new regulation, particular attention should be paid to whether companies should have a long-term or short-term perspective in which to introduce new products or solutions. This will also require determining which sectors and companies will be affected.

How many companies in the affected sector (s) would have been able to participate in the race for developing new innovative solutions if the energy performance of new buildings had stipulated that energy efficiency in new buildings had to be improved by 50% in 2012? On the other hand, the time perspective can also extend too far into the future. How many companies will risk developing new innovative energy-efficiency solutions if the ultimate goal is not achieved until 2025? What is an ideal time perspective?

This will depend on a specific assessment of the affected sector, of course, but also on assessing the technology required to meet the new set of rules. Regulations should allow adequate time for innovation. If new national requirements are implemented too quickly, companies may opt to relocate to countries with less stringent rules. In other cases, overly strict regulations could prevent new products from entering the market.

A significant dilemma in this context involves the difficulty of predicting technological trends over a long period of time. This means that legislators must ensure that the legal requirements create a framework for technological flexibility and formulate this as an ultimate aim rather than basing the legislation on existing technology. The energy performance of new buildings is an example of this. Here a new building's total energy consumption replaced the former requirements imposed on the individual components, e.g. windows, heat pumps, etc.

It should be stressed in this respect that the Building Code's requirements vis-à-vis the energy performance of new buildings, and the time frame associated with this, are supported by all the stakeholders interviewed. In general, they are quite satisfied with both the level of regulation and the time frame for the energy performance of new buildings. Companies need time to plan and launch product development, develop new services and plan the conversion of production so this can take place without unnecessary costs.

For the notable reason that future requirements will have such a significant impact on companies' innovation activities, the interviewees emphasized the importance of authorities giving them "early warning" of future requirements and anticipated legislative changes.

A few companies also emphasize that the introduction of voluntary standards, e.g. the more ambitious low energy class 2015, could be an important tool in stimulating innovation among the sector's leading and most development-oriented companies. This type of more ambitious, voluntary standards would make it easier for the industry's most progressive companies to communicate how their products differ from currently available products in the market.

4.4 How much leeway is needed?

In the area of building regulation, performance-based requirements have been increasingly introduced on an ongoing basis. One aim of introducing performance based requirements was to create a platform for greater flexibility in designing buildings and solutions. This allows for more leeway in terms of functionality and design without compromising on safety, health, etc.

In the vast majority of cases, it is not possible to completely do away with minutely detailed requirements in favour of performance-based requirements only. The dilemma – or challenge – is therefore to create the best possible combination of performance-based requirements and detailed requirements. In some cases it may be necessary to use more detailed requirements to supplement performance-based measures. In other instances, the level of detailed regulations could be minimized. In any event, it will depend on a specific case-by-case assessment.

Below are some examples from the case studies where the degree of detailed requirements varies.

In 2004, performance-based fire requirements were introduced to replace the existing detailed fire safety requirements. The purpose of introducing new performance-based requirements was to enhance the development of new types of buildings by providing more flexibility in the design and layout of new buildings without compromising on fire safety. Prior to the new performance-based fire requirements, rigid detailed security rules prevented the establishment of new and more modern, complex modern edifices.

There are few examples of minutely detailed requirements supplementing performance-based fire regulation. Even so, the case involving performance-based fire requirements shows that the wish for more innovation in the construction industry goes hand in hand with safety concerns. Safety is still an important element. Several interviewees pointed out they have not compromised on safety and that no fires have erupted due to lower safety arising from the performance-based fire requirements.

In the case involving accessibility, we find a predominance of performance-based measures, but the level of minutely detailed regulations is significantly higher than under the performance-based fire regulations, which directly inhibits the development of new innovative solutions.

Organizations for the disabled have been instrumental in introducing more detailed requirements, as they believe that detailed requirements are necessary for securing accessibility to public buildings for disabled people. For instance, organizations for the disabled find it hard to believe that providing access around toilets would work if it is left up to architects and developers of the building projects to provide such solutions within a free framework that would benefit disabled people. In order for a disabled person in a wheelchair to be able to access a toilet actually requires lots of space, not to mention a number of specific installations such as lower-level washbasins.

Therefore, these organizations have focused on introducing a number of specific requirements for the design of facilities for the disabled such as the distance between toilet and washbasin, doors that must open outwards, etc., as they believe this is the only way to ensure that these conditions are in order.

The case involving accessibility also illustrates that the issue of more innovation at the companies affected cannot be simplified into stating that if only the number of detailed requirements were reduced in certain area, the companies would increase their innovation activities. Several interviewees pointed out that accessibility for the disabled does not have a high priority and is not even considered until relatively late in the building process. This would suggest that current regulations could be improved by promoting the development of effective, integrated accessibility solutions for the disabled in the construction industry.

Several of the interviewees state that we could learn from experiences abroad, including the United States, Norway and the UK in terms of creating better accessibility for the disabled while at the same time driving innovation among Danish companies.²⁶ There are a number of examples of accessibility rules being included in broader laws including anti-discrimination, etc. This would stimulate companies to prioritize accessibility and embrace this in the early stages of new projects, which has actually led to the development of a range of intelligent and innovative solutions in countries that follow this practice. It has also contributed to greater focus on accessibility for the disabled in the educational programmes for architects, engineers, etc., who are thereby better prepared to include this element in the planning of new projects from the outset.

Difficult to monitor performance-based requirements

Another significant dilemma relating to the issue of how much leeway is too much is that it is much easier to monitor compliance with detailed requirements. All other things being equal, it is much easier to monitor a number of absolute measurements associated with specific products – e.g. a heat pump that must reduce its energy consumption by 50 percent.

It is much more difficult to monitor whether newly constructed buildings comply with the provisions of the energy framework stipulating that the combined energy consumption must be reduced by at least 25 percent in 2010, 50 percent in 2015 and 75 percent in 2020. It has turned out to be difficult to assess whether new buildings meet these standards. This is further complicated by the fact that different countries often have different ways to control measurements.

Another example is found in the case involving performance-based fire requirements, which require documentation for “unconventional” solutions. Fire safety must be documented through performance-based analysis and technical calculations of factors like the spread of heat and smoke, the effect of fire safety installations and evacuation times. The types of programs used for producing documentation material will vary from one construction project to another. Moreover, it is generally considered to be theoretically very uncertain to predict how a fire will develop. This makes it difficult for municipal case officers to evaluate and control the documentation material, which in turn has, in some cases, resulted in a reluctance to approve unconventional new solutions.

²⁶ Danish Building Research Institute, Professor Camilla Ryhl, Arkitekterne Bahn, Partner, Erik Bahn.

4.5 How many resources are required for intelligent regulation?

All other things being equal, new regulations impose costs on the companies affected by regulation. However, this analysis assumes that in the long term regulation can be beneficial for companies on whom the regulations are imposed.

In most cases, the use of intelligent regulation will presumably require additional investments in the public sector, as intelligent regulation requires in-depth knowledge of market and business conditions in Denmark and abroad.

There will also be costs associated with the administration of the new regulations as well as a need to enhance competences throughout the public sector. In the case of performance-based fire requirements, case officers in the municipal system need training to be able to evaluate and process construction projects based on performance-based fire requirements.

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5. Policy recommendations

The purpose of new regulation is to achieve overarching goals in relation to solving societal challenges, including a better environment, less energy consumption and better welfare services. Yet it would also be beneficial to consider innovation when drafting new regulations.

Intelligent regulation can therefore be conceived as a business and innovation policy tool that could potentially strengthen innovation. One advantage of using regulation is that it will affect all companies and that the costs associated with using the instrument will be relatively small compared to other policy tools.

Based on the lessons learned in the construction industry, we have identified a number of key areas that public authorities could consider when contemplating the use of intelligent regulation.

Based on our research, we propose the following recommendations:

1. *Systematic inclusion of markets and experts*: public authorities must work together with the private sector, trade organizations and experts to discuss how regulation can support the development of innovative solutions.
2. *Intelligent regulation cannot stand alone*: it is crucial to regard intelligent regulation as one of many tools that should be supported by other initiatives, such as public procurement.
3. *Formulate intelligent regulation in areas where there are national positions of strength*: these areas will often comprise competitive companies and specialized knowledge institutions with the prerequisites and qualifications for developing new solutions and engaging in dialogue with the relevant public authorities.
4. *Dynamic approach*: assess and adjust regulation continuously to maintain a competitive advantage.
5. *Competence development in the public sector*: using intelligent regulation will in most instances presumably create a demand for competence development throughout the public system.
6. *Intelligent regulation should be founded on general principles*: 1) *performance-based requirements*: replace detailed requirements with performance-based measures wherever appropriate; 2) *Ambitious goals*: when formulating ambitious goals, make sure they can be achieved within a realistic time frame; 3) *Adequate time for innovation*: make sure intelligent regulation allows for time to innovate.

Recommendation #1: Systematic inclusion of markets and experts

In Denmark, the organization of new regulation has always been founded on close dialogue and knowledge sharing among the private sector, interest groups and experts.

This practice should definitely continue as part of the formulating of intelligent regulation, but it should become more systematic. Public authorities should engage in close dialogue with the private sector, interest groups and other experts as to how regulation can support the development of innovative solutions while at the same time establish an ultimate goal that enables as many companies as possible to comply with the new regulation.

In this respect, it is important to organize a process related to the actual drafting of requirements and rules that enables small companies and sectors to influence the process.

In this respect, authorities may have to become more proactive when establishing requirements and rules in areas where the players are relatively small and not well organized. For instance, public authorities should expect to allocate more resources to amass knowledge about a sector's technological level and development potential.

Recommendation # 2: Intelligent regulation cannot stand alone!

It is important that intelligent regulation be regarded as a tool supported by other initiatives to reap the full potential.

A first step in this process would be to draft sector-specific analyses to assess whether the sector in question has the skills necessary for meeting the new requirements. If the sector is characterized by a large proportion of small, traditional companies (such as Danish window manufacturers), it will be challenging to develop new products, technologies, etc., to comply with a new set of rules.

The next important step is to ensure that the knowledge base and the knowledge capacity in both companies and research institutions are adequately developed in the particular area of interest. Public research should be upgraded or targeted at specific areas. Furthermore, the public sector can take the initiative to carry out development projects that will assist companies in streamlining their strategies.

Finally, the public sector could help to ensure that there is a demand for new innovative solutions by increasing its strategic use of public procurement, tenders, competitions, etc. One such example is accessibility, where a new building for the organization for the disabled was developed on the basis of an innovative public process, which resulted in a range of new innovative solutions. Another example is a competition for energy-efficient residential housing, launched in the 1990s. The winner was awarded a public contract for the construction of at least 400 houses.

Recommendation #3: Formulate intelligent regulation in areas where there are national positions of strength

It should be a special aim in Denmark that Danish regulation should stimulate innovation among Danish companies. This means that regulation should address national positions of strength and focus on market access, skills and expert knowledge.

It would be easier for governments to formulate new, intelligent regulation in areas where local companies are already specialized and knowledgeable. This ensures that regulation is based on specialized knowledge, and the private sector is generally more willing to engage in partnerships in areas where they already have expertise.

Furthermore, it should be expected that a number of companies, in particular leading companies, will actually be able to comply with the new regulations. It is also very likely that there is a strong knowledge and research environment in this area to provide expert guidance in the actual formulation of new requirements and the development of new knowledge, tools, etc.

This should not take place at the expense of healthy, effective competition, however, as competition is vital to productivity, growth and prosperity.

If a sector is dominated by a few large companies and many small companies there is a risk that stricter requirements will benefit the leading manufacturers and eliminate the small ones. This could lead to a monopolistic situation and would not be economically beneficial but would instead inhibit competition and ultimately lead to higher consumer prices.

Recommendation # 4: Dynamic approach

Once new regulation aimed at promoting growth and innovation has been designed and implemented, it is vital to continuously evaluate and adjust the regulations to secure a competitive advantage. Moreover, the adjustment should address new technological advances and international trends.

This is natural and obvious (but far from easy) in the case involving the energy performance of new buildings focus will be on continuously tightening the requirements for energy efficiency to secure a competitive advantage over companies from other countries that will be obliged to implement the EU directive.

But it is also true of other sets of regulations, such as the performance-based fire requirements implemented in 2004, that they also need to be adjusted to secure a competitive advantage. Most other EU members states have subsequently implemented performance-based fire requirements, which has eliminated the competitive advantage that Danish companies were able to build up immediately following the implementation of the regulation in Denmark.

Recommendation # 5: Competence development in the public sector

The use of intelligent regulation will often create a need for additional public resources. The actual design of intelligent regulation will require in-depth knowledge of market and business conditions in Denmark and abroad.

It will also necessitate competence development among legislators to adopt a proactive approach where the new regulation will in many instances require a longer time frame, the development of new technology and new and improved products.

It will also require an upgrade of legislative skills in designing regulation that gives companies more leeway in developing new solutions.

Finally, in some cases there will be a need for competence development among municipal case officers. In the case of performance-based fire requirements, the argument is made that the case officers are not adequately trained to evaluate more complex construction projects or relevant documentation.

Recommendation # 6: Intelligent regulation should be founded on general principles

When drafting regulation to promote innovation and economic growth in the private sector, a number of principles have been identified to support these efforts.

Performance-based requirements

To the extent it is feasible, it is recommended that detailed requirements be replaced by performance-based measures. In the area of building regulation, a growing number of performance-based measures have been implemented in recent years. One aim of introducing performance-based requirements is to create greater flexibility when designing and laying out buildings and solutions. This allows for a greater degree of freedom in terms of functionality and design without having to compromise on primary considerations such as safety, health, etc. The introduction of performance-based fire requirements in 2004 and the energy performance of new buildings in 2006 are both examples of how detailed requirements are replaced by performance-based measures. Our case studies show that both examples have resulted in innovation and growth at many of the affected companies.

Ambitious goals

It is recommended that long-term ambitious goals be established. This is vital, as companies will demand clearly defined goals in terms of the intent of the regulation in order to assess the effect on actual production. The goals should be so ambitiously formulated that it will require the development of new and improved products to comply with them. The case of the energy performance of new buildings is worth highlighting in this context as it states that energy consumption in new buildings should be reduced by at least 25 percent by 2010, 50 percent by 2015 and 75 percent by 2020. It will be up to the market to develop innovative, cost-efficient new solutions that will help to achieve the desired effects.

Time for innovation

It is recommended that intelligent regulation provides adequate time in which to innovate. The time frame would of course depend on an actual assessment of the affected sector but also on an assessment of the technologies required to develop the new solutions that comply with the new regulation. If new national requirements are implemented too quickly, companies may relocate to countries with less stringent rules. In other cases, overly harsh regulation could be a barrier to new products. Hence, legislators should create requirements that establish a framework for technological flexibility as an ultimate goal rather than basing requirements on a knowledge of existing technologies.