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Small Great Nation

Innovation - the key to sustainable growth

Executive summary

Preface

The collaboration between Kraka and Deloitte on the Small Great Nation project analyses the long-term prospects for the Danish society. The initiative is independent of political and economic ideologies and interests. The initiative utilises existing research-based knowledge and contributes new, independent analyses that result in evidence-based proposals for creating a better Denmark. This is the fifth report under the Small Great Nation project. This time we examine the UN's Sustainable Development Goals (SDG) and focus on innovation and research and development (R&D).

The United Nations Sustainable Development Goals entered into force in 2016, binding all 193 UN member states. The goals set an ambitious development direction for the entire population of the world. However, the goals contain some dilemmas. For example, some of the goals concern prosperity: No Poverty, Zero Hunger, Good Health and Well-being, and Decent Work and Economic Growth, achievement of which, all else being equal, would lead to an increasing drain on the world's resources. Other goals are about sustainability: Affordable and Clean Energy, Sustainable Cities and Communities, Responsible Consumption and Production, Climate Action, Life Below Water and Life on Land. These require a lower demand on the world's resources. Hence, there would seem to be contradictions here, where achieving one type of goal risks reducing the achievement of the other type of goal.

A third group of goals, Quality Education; Industry, Innovation and Infrastructure; and Peace, Justice and Strong Institutions, is really the means to the end of solving the Gordian Knot. If the world invests sufficiently in these goals, global productivity could be improved, and increasing productivity would improve living standards and reduce resource use.

Previous reports from the Small Great Nation project have analysed a number of aspects of education and strong institutions. Therefore, in this report we focus on innovation. In the next report we will focus on climate.

Innovation is contagious. This is good, but it means that the individual company does not get the full benefit of its innovative efforts. Hence, there is a socio-economic gain to be had by state support of companies' innovative efforts through, for example, patent and rights systems, research collaboration, tax rebates and direct support of innovation. In other dimensions, the contagion means that entrepreneurship is inherited and children who grow up in self-employment environments more often become self-employed themselves.

Denmark spends a lot of money on R&D, and green Danish patents are of a higher quality than those in many other countries. Nevertheless, Danish companies have much lower sales volumes of newly developed products than other EU countries, which is surprising. In this report, you can read about this, and many other issues.

We would like to thank the secretariat's staff members: Jesper Kühl, Mikael Bjørk Andersen, Thomas Wilken, Andreas Gotfredsen, Anne Marie Krogsgaard Andersen, Sebastian Hørlück, Amanda Egelund-Müller, Therese Aunbirk Jeppesen, Phillip Henriks, Anton Brandt Frandsen, Mie Hagenbo, Christian Lund Sørensen, Jakob Langager Christensen, Cecilie Dohlmann Weatherall and Mikaela Stoklund Dittlau.

Happy reading!

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1. Executive Summary[1]

The Sustainable Development Goals

The UN's Sustainable Development Goals were adopted by the 193 member states at the United Nations Sustainable Development Summit 2015, held in New York from 25 to 27 September 2015, and entered into force on January 1, 2016. The purpose of the goals is to set the course for sustainable global development. The global goals consist of 17 specific goals and 169 associated targets that commit the UN's 193 member countries to, among other things, abolishing poverty and hunger, reducing inequality, ensuring good quality education and better health for all, and providing decent work and sustainable economic growth.

Danish achievement of goals and business potential

Denmark has adopted these goals, so they are a natural starting point for this report from the Small Great Nation project. The goals could have significance for Denmark for a number of reasons: Will Denmark be able to achieve the goals, and will development in Denmark and in the Danish economy have to be adjusted in order for Denmark to comply with the goals? As the goals have an obvious global focus, it is equally relevant that Denmark considers what it can and should do to assist less prosperous countries to achieve their goals and how the focus of other countries on their own goals will also affect Denmark. For example, it is relevant to ask how Denmark would be affected by the environmental focus of other countries. There could perhaps be potential for Danish companies to develop and market technologies that, due to the global goals, experience increased demand.

Support for ambitious goals

The nature of the goals is universally positive, and therefore, they enjoy widespread support. The goals apply to both rich and poor countries, and many countries have a long way to go if they are to achieve the goals. Thus, at the global level, the goals are both comprehensive and ambitious.

Denmark is doing well for many goals

In Chapter 2 we give the status of the extent to which Denmark is fulfilling its objectives. For many of the Sustainable Development Goals (SDG), Denmark is doing well compared to other countries. For example, SDG 2, which deals with the elimination of hunger, and SDG 6, which deals with clean water and sanitation, are not problems in Denmark. Hunger in Denmark was reduced to a minimum long ago, and virtually everyone has ready access to clean water and sanitation. SDG 1 is about eradicating poverty and SDG 10 is about reducing inequality. Calculated using an absolute poverty measure, there is virtually no poverty in Denmark. However, relative poverty exists in Denmark – that is, there are people in Denmark whose income is substantially lower than the median, but almost regardless of how inequality is calculated, Denmark is among the countries in the world that have the lowest inequality.

Sustainable energy and climate action are challenges

In other areas, the situation is less impressive in Denmark. SDG 7 is about sustainable energy, and global goal 13 is about climate action - two issues that are closely related. The Danish Parliament has entered into a very broad agreement on a climate policy that confirms that, by 2030, Danish emissions of greenhouse gases must be reduced by 70 per cent compared to 1990 levels. Although Danish greenhouse gas emissions have been reduced over the past few years, Denmark still uses large quantities of fossil fuels. Achieving the 70 per cent target must be regarded as one of the major challenges facing the Danish economy, although it is certainly achievable if implemented wisely. Therefore, in the sixth Small Great Nation report, to be published in the summer of 2020, we are planning to investigate how Denmark tackles the climate challenge.

[1] This document serves as a summary in English of the full report titled "Innovation – Nøglen til bæredygtig vækst". The full report (Danish only) is available at www.sgnation.dk

SDGs from a Danish perspective

We show that achievement of the objectives is, to a great extent, related to a country's level of wealth measured by GDP. Therefore, consideration should be given to whether the goals ought to be set higher for prosperous countries like Denmark than for less prosperous countries, or whether Denmark can soon rest on its laurels when the less ambitious goals are met.

Limited Danish interest in SDGs

We also examine the Danes' knowledge and understanding of the SDGs. From a UN perspective, the results are disappointing. The Danes, and especially the smaller Danish businesses, have a very limited knowledge of the SDGs, and many find them irrelevant to Denmark. However, the latter may be due to the fact that the Danes are only looking at the goals from a global perspective, and therefore, they are only seeing improvements in less developed countries as the most important function of the goals.

Achieving some goals makes it difficult to realise others

Some of the goals are competing. That is, the realisation of some goals could make it difficult to realise others. If, for example, poverty and hunger were eliminated, and there were to be worldwide improvements in health and the quality of education, the basic living conditions of many people would be improved. However, all else equal, this would also mean an increased drain on the world's resources, which could make it more difficult to achieve the goals for sustainability, climate action, and for life in the sea and on land. In principle, for example, one could imagine that Denmark realises its goal of a 70 per cent reduction in emissions by drastically saving on our use of resources, but then, perhaps, the Danes would not be able to access as much healthcare, Denmark might not be able to finance a quite-so-good education system, and we could be forced to reduce the ambitions of SDG 8, which deals with economic growth.

Innovation can solve the dilemma via productivity

However, SDG 9 on industry, innovation and infrastructure may hold a key to the dilemma: If there were to be sufficient development and investment in new technology and improved production methods, it is possible to reconcile economic growth and increasing prosperity with a steadily smaller drain on resources, in a broad sense. The point is that technological development makes production processes more efficient: With sufficient innovation, a given amount of labour effort can produce more value per hour and reduce the effect on the environment. With increased value-added, goals such as better health, quality education and decent jobs can be accommodated. With a lower drain on resources, the ambitious climate and energy goals could be achieved while pursuing SDGs 14 and 15 on sea and land life.

SDGs 4 and 16 also support productivity

SDG 4 on quality education and SDG 16 on peace, justice and strong institutions, like SDG 9, could also support productivity growth and, thus, the achievement of the other goals. In previous Small Great Nation reports, a number of aspects of these global goals were analysed. The overall agenda may be lacking a global goal for stable and flexible capital markets, because if international capital markets, or those of individual countries, are unstable or inflexible, there will be insufficient investment to achieve the ambitious goals.

It begins with innovation

As innovation is absolutely crucial for realising the many Sustainable Development Goals, it is natural for this first Small Great Nation report regarding the SDGs to deal with the global goals concerned with innovation.

What is innovation?

Innovation as a theoretical economic concept was introduced by Joseph Schumpeter in 1912. Schumpeter defined it broadly as a constantly innovating element that encompassed the entire existing economic order: For example, old businesses die and new ones emerge and behaviour changes, which can increase productivity. In contrast, innovation can be very narrowly understood as the development of a new physical technology that improves a production process. Today, the most common concept of innovation is between these two poles. In Chapter 3, we measure Danish innovation efforts against those of other countries.

Danish innovation expenditure among the international elite ...

By international standards, Danish innovative activity is decent. Denmark is one of the relatively few OECD countries that lives up to the Barcelona goal that total public and private research spending should amount to 3 per cent of GDP. The government's target is for 1/3 of the total research to be carried out in the public sector, and this target is also met. Denmark is thus in the elite of the OECD judged by research expenditure.

... not only because of big innovation-intensive industries

One might then think that this was simply a result of the industry mix, for example, Denmark has a large innovative pharmaceutical industry. But this is not the case. Denmark is actually above the R&D level that one would expect based on its industry composition.

High and rising value of Danish "green" patents

When patenting is measured, it is typically done by simply counting the number of patents. This is too simplistic, since patents have different values and are part of "patent families"[2]. Using a new analytical approach, we compare the quality of patents rather than just the number. The good news is that the quality of Danish "green" patents over the past 25 years has been, on average, among the highest in the EU, and is still at a high level today.

Declining value of other patents

The not quite so good news is that the quality of all Danish patents has been high, but has now fallen to below the EU average. A trend that may be important to be aware of with a view to Denmark's future growth

Are we reaping the full benefits of the efforts?

Despite Denmark doing very well on many innovation measures, we do not appear to reap the full benefits of the innovative efforts. For example, there is a fairly low content of high-tech products in our exports.

Innovation is contagious

An important feature of innovations is that they are "contagious" in various dimensions. We look at this more closely in Chapter 4. Basically, a good idea can be adopted by anyone. On the face of it, this is good, because the more a good idea can spread, the more effective everyone becomes. On the other hand, easily adopted innovations mean that innovative companies do not get the full benefit of their innovation efforts. Thus, innovation efforts will be too small if innovation is left to a private, unregulated market alone. This may justify public intervention in support of innovation processes, and the greater the potential benefits from dissemination, the more the government should support innovation in a given area.

Dissemination effects when R&D workers change jobs

In a separate analysis we look at the dissemination of knowledge that occurs when R&D workers change jobs. There is a clear positive effect, which is a good argument for supporting R&D. The individual company does not reap the full return on its innovative efforts.

Danish patents are particularly well-cited

We also look at the international dissemination of knowledge that takes place via Danish patents. We can see that Danish patents are cited to a greater extent than other countries' patents. This points to yet another favourable dissemination channel for knowledge, and it is especially strong for green patents.

Agglomeration - higher productivity in big cities

An interesting hypothesis says that productivity and innovation increase when people live and work in close proximity. This is called the "agglomeration effect" and can be due to, among other things, the mutual positive dissemination of knowledge among employees. Therefore, if a person from an area with a low population density moves to a metropolitan city with a high population density, he or she can become more productive due to the positive externalities from close colleagues, etc. But the person moving can also positively infect others and thus amplify the positive effects. This can lead to higher wages and contribute to the ongoing demographic migration from rural to urban areas.

Agglomeration effects exist in Denmark too

Such agglomeration effects are well documented internationally. We show in the report that they are also present in Denmark, but only to a very limited extent. For example, a higher concentration of employees in an area increases hourly wages, even when we take into account that the types of workplaces and employees vary within the country, but the effect is very small. Denmark may be too small and uniform for significant differences in agglomeration effects to occur across the country.

It is unclear whether migration should be supported or discouraged

In addition to the modest agglomeration effects, a socio-economic assessment must also take into account such things as congestion, the increases in public revenue that result from higher wages, and personal preferences for living in urban or rural locations. The socio-economic consequences

[2] A patent family consists of the same innovation that has been filed in a number of different countries.

of increased or decreased urbanization are, therefore, unclear. Against this background, it is not recommended that the government provides support for the ongoing demographic trend towards migration to the cities, nor that it tries to counteract this trend.

Entrepreneurial areas create new entrepreneurs ...

In another analysis we look more specifically at how the inclination to be self-employed spreads in a geographically defined area, and we find that raising children in an area with many entrepreneurs can increase their tendency to become self-employed later in life.

... and the same applies to entrepreneur families

Innovation and entrepreneurship do not necessarily only spread in industries and areas but can also be inherited over generations. It is well-known that the social characteristics of parents greatly affect their children: If your parents are poor, poorly educated or poor payers, you yourself have an increased risk of ending up in the same position. Even though the so-called social inheritance may be lower in Denmark than in many other countries, it is still present to a large extent. In a separate analysis we take a closer look at how self-employed parents influence their children's job choices, and we find a clear tendency for children of self-employed parents to become self-employed to a greater extent than other children, thus entrepreneurship is inherited.

Public policy supports innovation

In a number of analyses, we examine the composition of the Danish incentive for innovation. We look at how the government should, in principle, intervene to support R&D, and how the existing schemes are, in practice, composed. It is a great advantage to society that innovations spread to the benefit of more, but there are no roses without thorns: If a company's innovations can be freely adopted by its competitors, the company's own return on its innovation effort becomes very small. Therefore, there is a need for society to protect innovations.

Patents are necessary

An example of such public intervention is the patent system, which, by limiting competitors' access to an innovation for specific purposes for a period of time, gives the company behind the innovation the opportunity to earn a return on its R&D investment. Thus, the patent system is necessary to encourage companies to invest in innovations, but it also limits the socio-economic return on innovation efforts. Thus, we can't do without patents even though they reduce the dispersion and application of new knowledge.

Innovation strategy: Easy in principle, complicated in practice

Therefore, a country's innovation efforts must necessarily take place as an interaction between public authorities and private companies. In principle, it is easy to state that the role of the authorities is to repair market failures where it is socially beneficial to do so and, in addition, that the authorities should leave the work to the companies. The reality is a lot more complicated:

Dilemmas in the public sector innovation strategy

On the one hand, innovation and dissemination of ideas should be supported, on the other, companies should be assured sufficient returns from their innovative efforts. Basic research conducted in universities is of low value if it does not emerge from the ivory tower, but the universities' cooperation with individual companies must not go so far as to distort competition. Not only do universities have to do research, they also have to educate candidates for both the private and the public sectors. Corporate returns are a crucial innovation driver, but corporate interests are often more short-term than society's interests. Innovation is associated with major risks - how is sufficient venture capital to be secured? Society may wish to promote, for example, climate research more extensively than what companies have private financial incentives to undertake. How is this handled?

A myriad of Danish schemes

Many dilemmas and obstacles rule out simple solutions to the public sector's effort to support innovation in Denmark. There is wealth of schemes that directly or indirectly support innovation and knowledge dissemination in the private business sector in Denmark: There is, for example, publicly funded basic research, free training of researchers for businesses carrying out R&D, direct innovation funding to finance innovation or dissemination of knowledge, tax deductions for R&D expenses, public funds for venture capital, etc.

Insufficient knowledge about the returns to public sector support of R&D

Although there are no quick and easy solutions, the Danish public sector's innovation strategy should reflect basic rules and should not be more complicated than necessary. We review Danish public sector innovation support and the principles that should be used to set eligibility criteria for

the support. There are good principled arguments for the many different support channels. At the same time, it is imperative that support schemes produce excess social returns, where the gains, in the form of increased productivity from innovation, offset the public expenditure on the schemes. Without such an assessment, there is a risk that the public sector's R&D could be too high, too low, or too unfocused. Well-designed follow up on schemes means that higher social gains can by reaped by adapting schemes as necessary, which will benefit both business and society.

Denmark is not lagging in access to venture capital relative to other countries

Well-functioning venture capital markets are of high value to businesses, as financing goes hand in hand with skills, which can take a good idea from the back room to a commercial success. Therefore, for example, the Growth Fund (Vækstfonden) fills an important void in the financial markets. However, Denmark's access to venture capital is on a par with comparable countries. This does not rule out that better access to venture capital could be an advantage, but this is a problem that Denmark shares with many other countries.

Section 1.1 and Section 1.2 below present, respectively, the central results of the analyses and a number of questions for discussion that follow naturally from the analyses.

1.1 The key analytical results

The report's key analytical results are:

Denmark and the Sustainable Development Goals

- Denmark is at the forefront in terms of meeting the Sustainable Development Goals (SDG) for, e.g., poverty, equality, health, gender equality, growth, etc. Therefore, overall, Denmark is currently performing well on achieving the global goals. This applies both when assessing the distance to the targets and when comparing Denmark with other countries. Although Denmark is at the forefront, most goals have not yet been met.
- Although Denmark is doing well overall, there are still major challenges in meeting the SDGs when it comes to the state of the world, i.e., in relation to climate, environment and sustainable consumption. However, these are challenges that Denmark shares with the rest of the highly developed countries and which will increasingly become challenges for developing countries as they achieve a higher level of prosperity.
- All else equal, some of the SDGs increase the drain on resources, e.g., No Poverty and Zero Hunger. Other SDGs require a reduction in the use of resources, e.g., Responsible Consumption and Production, Climate Action, Life in the Sea, and Life on Land. A third set of goals include real measures that, through productivity improvements, could solve the resource dilemma: These include Quality Education; Peace, Justice and Strong Institutions; and Industry, Innovation and Infrastructure. These SDGs therefore play a key role.
- Well-functioning capital markets are also a key means of reconciling the competing goals, but play only a minor role in the SDG framework. In many countries, poor access to finance and physical capital is a major obstacle to development.
- Many of the SDGs are positively related to a country's level of wealth, measured by GDP, and can be significantly easier for wealthy countries to achieve. Thus, Denmark, and the countries we normally compare ourselves to, score about 90 out of 100 points for the global goals that deal with poverty, hunger, health, education, etc. Countries with the lowest per capita GDP only score between 30 and 40 points. Goal achievement should be assessed in relation to financial capacity, and it could be advantageous to set more ambitious goals for prosperous countries.
- Denmark is also at the forefront in terms of industry, innovation and infrastructure goals. By focussing on developing and investing in new green technology, business and industry could become even more energy efficient than today. The CO_2 emissions of Danish industry per value added income have been declining sharply over the period 2010-2018, from an index

of 100 to around 80, but they certainly need to fall much more if Denmark is to meet its climate goals and obligations.

- Around half of the Danes have no knowledge of the SDGs, and most others have only a limited amount of knowledge. However, highly educated people have greater knowledge of the global goals than other groups. 66 per cent of Danes believe that setting the global goals makes a difference to the world community, and about 50 per cent believe that they make a difference for Denmark. Thus, many Danes are sceptical about whether setting such global goals will be able to change the global and, particularly, the Danish path to achieve these goals.
- Setting of the global goals and Denmark's official adoption of them are hardly sufficient to influence the attitudes and behaviour of companies and citizens enough to achieve the goals. If Danish politicians want the global goals to be truly long-term benchmarks for the direction of Denmark's development, it may be necessary not only to monitor the progress towards the goals, but also to encourage companies and citizens to actively work towards achieving the goals. For example, regulation is absolutely crucial to achieving the climate targets, and a tax on CO_2 emissions is an obvious instrument as it ensures cost minimization.

The innovative Denmark

- Innovation covers everything from the development and improvement of materials and more efficient production processes to better collaboration among people. Innovation increases the wealth of society through a higher real wage and can reduce the environmental impact of production. Innovation can thus play a key role in achieving what, on the face of it, are competing global goals.
- Denmark is considered to be among the European elite in terms of innovation. The good conditions are due to, among other things, good access to a highly educated labour force, a research sector that is of a high international standard, and good digital infrastructure. Expenditure on R&D is high in both the public sector and private companies, and Danish companies also have high patent and trademark activity relative to other EU countries.
- The quality of Danish patent families - which is the most accurate measure of patent applications for unique ideas by Danish firms - has fallen by 7.4 per cent from 2012 to 2016, relative to the average for 13 comparable European countries.[3] The quality of the Danish patents in 2016 was thus ranked the lowest it has been relative to the 13 European countries over the period 1992-2016.[4] During the same period, Denmark had close to the average number of patent applications per capita among these 13 countries.
- From the mid-1990s until 2009, Denmark saw a sharp increase in the number of green patents. From 2007 to 2016, Denmark was the country among 13 obvious European comparison countries that took out the second highest number of green patents per capita. At the same time, the quality of the green Danish patents was, on average, the best among the 13 European countries over the entire period from 1992 to 2016. On average, the Danish patent quality was six per cent above the average across the 13 countries.
- Denmark spends a relatively large share of GDP on R&D compared to other countries. With a share of 3.1 per cent in 2017, Denmark was the OECD country that spent the 6th largest share of GDP on R&D, and thus was significantly above the average share for the OECD countries, which was 2.1 per cent. Denmark R&D expenditure share was also higher than several of the countries with which it is often compared.
- R&D expenditure in Denmark, measured as a share of GDP, increased significantly over the period 1995-2009, when Denmark went from spending about 1.8 per cent of GDP to around 3 per cent of GDP, which is also the current level. The increase was mainly driven by sharply rising R&D spending by the private sector. Denmark is one of the few EU countries that meets the Barcelona target of at least 3 per cent of GDP going to R&D activities.
- The high level of R&D expenditure in Denmark is not simply the result of a favourable industry mix, e.g., its large pharmaceutical industry. Denmark is actually above the level of R&D that one would expect based on its industry composition.

[3] A patent family consists of the same innovation that has been filed in a number of different countries.
[4] However, the recent figures are subject to considerable uncertainty due to the short observation period.

- The share of public sector R&D expenditure that is devoted to energy and environmental research has fallen from 8 per cent to 4 per cent since 2010. According to the latest figures, Denmark spent a smaller proportion than Germany and Sweden. This development is remarkable, as Denmark emphasises that it must contribute to solving the global climate crisis by investing massively in the development and dissemination of green technology. The newly agreed distribution of public sector research funds will rectify this so that the share going forward will be around 9 per cent.
- There is evidence that Denmark enjoys fewer benefits from its innovation activity than many other European countries. Among other things, Denmark is ranked low compared to other EU countries in terms of its share of total exports coming from medium or high-tech products, and compared to other EU countries, Danish companies have a much lower turnover based on sales of newly developed or significantly improved products.

Ideas and innovations are contagious

- Over the period 1995-2010, patent families filed by Danish companies or individuals were quoted at least 50 per cent more, on average, than patent families originating from the 12 most comparable other European countries. For 12 of the years during this period, Denmark had either the most or the second most citations per year per patent family among these European countries. From 2011 to 2016, Denmark still ranked among the top four countries in all years in terms of average citations. This is indicative of both the high quality of Danish patents and the fact that Danish R&D has relatively high international impact. However, the distance to the average for all 13 European countries decreased from 2009, so that, in 2016, Denmark only had 24 per cent more citations per patent family than the average, which is the smallest distance in over twenty years.
- Also, Danish green ideas spread relatively more compared to the 12 other European countries. In particular, the Danish green ideas began to spread a lot throughout the 2000s, where the average number of citations for green patent families over the period from 2007 to 2009 was more than 100 per cent above the average for the 13 European countries (i.e. the 12 EU countries plus Denmark), while the number of citations per capita was more than 250 per cent over the average from 2009 to 2012. However, it is clear again that the spread of Danish green ideas relative to the other countries has declined since 2009.
- Our analyses show that when R&D workers change jobs, there is a positive productivity effect for the new company. The effect corresponds to the following: 10 new employees who have worked in R&D in another company raise productivity in the recipient company by just under 1 per cent. Thus, R&D activity in Danish companies is not only beneficial to the companies themselves, but through knowledge dissemination, it also benefits other companies and, thus, the entire society.
- Agglomeration means spatial concentration of people and activities in, for example, metropolitan areas, and international literature indicates that, via mutual contagion, agglomeration results in higher productivity and, thus, higher hourly wages and economic prosperity. The benefits arise when concentration of companies and employees, among other things, facilitates knowledge sharing and dissemination, creates a better functioning labour market, and provides economies of scale for common input factors, such as specialized subcontractors, etc.
- Our analysis of productivity and hourly wages shows that hourly wages are positively related to a range of agglomeration measures, including urbanization or employment density, i.e., number of employees per km^2 in the municipalities. However, the analysis shows that the effect on wages is extremely small and almost non-existent. A 10 per cent higher employment density is associated with a 0.03 per cent higher average hourly wage. In isolation, this effect corresponds in round figures to the hourly wage being just under 0.1 per cent higher in Ballerup, with an employment density of just under 1,200 employees per km^2, than in Vordingborg, with an employment density of 20 employees per km^2, i.e., a negligible effect.
- The Danes' ongoing migration from rural to urban areas thus seems to be only explained by agglomeration benefits to a limited extent. Our analysis also shows that the real differences in hourly wages across municipalities in Denmark are relatively modest. Among other things,

it is shown that up to 90 per cent of the wage differential between a range of municipalities is simply due to differences in the composition of jobs in the municipalities.

- The expected agglomeration effects have been used as an argument to support migration from rural to urban areas. The analysis does not support this argument. Negative congestion effects associated with increasing population density can be counteracted through government intervention, and here the most direct instrument is road pricing.
- Entrepreneurial parents double the likelihood that their children will later become entrepreneurs. Other researchers' analyses confirm that the results also apply when taking into account parents' wealth and omitting from the sample those who have become self-employed because they have taken over their parents' business. It shows that entrepreneurship can be promoted through role models and is not only the result of, for example, inherited characteristics or inherited wealth.
- The parent of the same sex as the child is particularly important for whether the child chooses to become self-employed: We find that there are around 48 per cent more men who become self-employed when the father has been self-employed compared to when the mother has been self-employed. For women, this difference is slightly lower but goes in the same direction, with around 23 per cent more women becoming self-employed if their mother has been self-employed compared to if their father has been self-employed. The reason may be that children identify more closely with, spend time with, and imitate the parent of their own sex, which is underpinned by studies in social learning. [5]
- One way for innovations to become commercially successful is through entrepreneurs and new businesses. In an analysis we find that a high concentration of self-employed in a municipality can increase the likelihood of the children of the municipality becoming self-employed later in life. A child who lives for ten years in the municipality with the 10th highest concentration of self-employed people compared with the municipality with the 10th lowest concentration, has a 14 per cent higher likelihood of becoming self-employed. This applies regardless of gender.

Society's support for innovation and R&D

- It is difficult for each company to prevent its innovations from spreading to other companies. This is a problem for the company that does not get the full return on its ideas, but it is a benefit to society that good ideas are used by many. The patent system, which gives companies temporary exclusive rights, is necessary for innovators to earn reasonable returns on their development efforts, but it reduces dissemination. In addition to the patenting system, the socially beneficial dissemination of knowledge is an argument for governments to financially support innovation activities, for example, through tax deductions, research collaborations with universities, or by providing access to venture capital.
- Well-functioning venture capital markets can have significant effects on the level of innovation in an economy, and the positive externalities of venture-financed new and innovative companies appear to be significantly higher than the externalities of R&D investment in existing companies. The US, Israel and Canada stand out globally, having venture capital markets that are 5-6 times larger in terms of share of GDP than the European countries.
- Denmark has a venture capital market that, relative to the size of the economy, is the same size as in Finland and Sweden, and larger than in, for example, the UK, Belgium, the Netherlands, Germany and Norway. In other words, Denmark does not have a particular lack of venture capital for new and innovative companies relative to comparable countries.
- The interaction between financial capital and investor knowledge is particularly valuable for new and innovative companies, including knowledge of how inventions can be commercialized. Thus, the role of state support for new and innovative companies is not only to provide capital, but equally to support knowledge building and know-how on the investor side. In this light, the current structure of the Growth Fund (Vækstfonden) seems reasonable.
- If it is politically desirable for Denmark to contribute more to the global green transition than just a purely Danish transition to climate neutrality and fossil fuel freedom, there is an obvious

[5] However, sectoral gender inequality can help explain the gender effect.

opportunity to support the development of new green technologies more than the purely Danish target would indicate, thereby making the green transition cheaper and more attractive at the global level. The Finance Bill for 2020 includes the creation of a new state fund of 25 billion DKK that aims to finance green restructuring. However, only one fifth of the funds are to be used for investments in new innovative green companies. The rest is to be used for export credit and loans for projects based on already existing technologies. The fund is thus neither targeted to innovation nor green change, but is mainly traditional and inappropriate business subsidy.

- In Denmark, innovation and entrepreneurship in private companies are supported through a large number of schemes, including training of PhD students, special tax deductions and tax rules for expenditure on R&D, and various forms of support and grants for R&D. In total, around 7 billion DKK is spent on government support for innovation, of which, about 2½ billion DKK is part of the business promotion system. Another group of innovation-oriented funds and schemes are more focused on establishing contacts and disseminating knowledge. Knowledge dissemination, etc. implies positive externalities for other players in the economy. Increased knowledge for one person who learns about the latest technology, has a positive impact on the performance of that person's colleagues. This is an argument for government management or support of the dissemination of knowledge, etc.; similar to the way it subsidises education.
- Public support for R&D can result in social gains in the form of increased productivity directly from the supported innovation and indirectly from the dissemination of knowledge. However, it is important that the support focuses on the spillover effects: A lot of jobs, or a high export share are not relevant arguments for supporting particular industries. And when determining the amount of support, it is not only the positive spillover effects, but also the costs in the form of public expenditure, that must be taken into account. There is insufficient information to determine whether the overall Danish level of support is appropriate today.
- The impact of university research on companies and citizens is an important reason why research is of value to society, but in Denmark today there are only limited incentives for knowledge dissemination from universities, via, for example, their strategic plans as agreed in the contracts between the institutions and the government. A recent expert committee investigated a performance-based allocation of basic funding to universities. The committee proposed indicators and qualitative elements that target the promotion of research quality, but only considered to a lesser extent whether knowledge dissemination to companies and society could or should be promoted. If the committee's recommendations are followed, knowledge dissemination will not receive greater encouragement than it gets today.

1.2 Questions for discussion

The purpose of the work in the Small Great Nation is to map Denmark's strengths and weaknesses and point to expertly based solutions. Therefore, based on the analytical results, we present here a number of questions and possible answers to the issues raised:

Denmark and the Sustainable Development Goals

- As environmental requirements increase, cost-effective technologies must be developed that can reduce emissions and resource consumption in production. Therefore, innovation and research are central if the seemingly contradictory global goals for prosperity, climate, and the environment are to be solved simultaneously. Therefore, are innovation and research really Denmark's most important contribution to achieving the global goals?
- Is it a problem that about half of the Danes do not believe that the global goals make any difference for Denmark and that small and medium-sized companies are only working to a small extent on meeting the global goals? Or does this indicate that the global goals are mainly concerned with problems that are more relevant to the outside the world than directly to Danes and Danish companies? Are these companies missing out on growth potential?

- Well-functioning capital markets are not included as an independent global goal, and there are only few indicators concerning access to banks and loans, which are included in the SDG 8 and 9, even though well-functioning capital markets, like innovation, can support productivity growth. In the development of the global goals, have well-functioning capital markets been given too little attention? What should Denmark do to rectify this?
- There are no specific Danish plans for achieving the global goals, and Danes and Danish companies are not very interested in the goals. Do Danish politicians generally want the global goals to guide Denmark's development, or do they just want to appear to be one of the 'good guys' by officially adopting the global goals? If the goals are to be the benchmarks for the direction taken by Denmark, is it sufficient to adopt them and then their leave the implementation to private initiatives? Should policy be supplemented by, for example, regulations that ensure the achievement of the goals?

The innovative Denmark

- Denmark has high research expenditure in international comparisons, both in the public sector and in private companies. Can Denmark's international leadership position be maintained through public sector investment in R&D and public sector support for R&D activities in private companies, through good basic conditions, and by maintaining public sector research at the international level? Should the publicly funded research effort be further increased, possibly focusing on supporting solutions to the climate challenge?
- Denmark is at the forefront of innovation, which is largely due to its highly skilled workforce, having a research sector at an internationally high level, and having good digital infrastructure. How can Danish authorities create the necessary conditions that also to ensure that Danish innovation will remain in the international top class going forward, and maintain the high level of investment in the education and research sectors as well as support the rapid and efficient roll-out of the next generations of technological infrastructure? What role does collaboration with companies play in this regard?
- The quality of patent families originating in Denmark has been declining in recent years, but from a high level. Is this merely a natural normalisation as part of the development that, in particular, industry is exposed to, or can it be reversed? And if so, how?

Ideas and innovation are contagious

- R&D activity in the individual company also has beneficial effects for other companies through knowledge dissemination via employees changing jobs. This provides an argument for subsidizing the R&D activity of private companies, e.g., through tax rebates on R&D expenditure. The already agreed increase in the tax deduction for R&D expenditure, which is planned to be phased in by 2026, with a deduction rate of 110 per cent, is a solid contribution. Is the level thus appropriate or should the authorities' encouragement and involvement be further increased or perhaps instead reduced?
- Danish ideas are widely disseminated especially the green ideas. How should the government take into account the particularly high dissemination effect of green ideas when deciding how much funding should be allocated to R&D activities?
- There are only negligible private and social economic benefits from Danes living and working in close proximity, but, for example, congestion negatively affects the cities. Road pricing is, in principle, a good instrument for combatting congestion, but is not used. Is the time now ripe for road tolls? On the other hand, relocation of government jobs has been used, but ex ante analyses have cast doubt on the desired economic effects. Did the relocation meet its goal?
- People become more entrepreneurial when they come from areas where there are many entrepreneurs or grow up in entrepreneurial families. Role models thus appear to be of importance. How can this knowledge be used to promote entrepreneurship? Can young people be given opportunities to interact with successful entrepreneurs in primary and secondary school, and in further education? Should entrepreneurship be taught? Should special measures be taken in areas with a low level of entrepreneurship?

Society's support for innovation and R&D

- The state should support R&D activity through direct funding of basic research, with tax rebates for private companies' R&D activities, and with direct support for and co-financing of new promising companies. No particular shortcomings in overall R&D support can be pointed to, but earmarked subsidies are unwarranted and should be avoided, particularly in the green

area, which has received a lot of attention. In practice, how are green R&D efforts that develop technologies with the greatest potential to be ensured? How should this coincide with initiatives that make a Danish contribution to lower CO_2 emissions, for example through the quota market and the tax structure?

- There is neither sufficient insight nor oversight to enable the social returns to public sector support for innovation to be assessed. Is it possible to undertake focused innovation support without this information? Is it worth undertaking an analysis that can provide information about the effects of innovation support?
- Only 5 billion DKK out of the total of 25 billion DKK in Denmark's Green Future Fund is to go to initiatives that support innovation in green technology. An unfocused green effort makes the solution to global climate problems more expensive than necessary and risks losing popular support for the green transformation. In this context, how should the priorities of the Green Future Fund be adjusted in relation what is planned?
- Innovation is supported via many channels, but there is a lack of understanding of the types of companies that receive innovation support. An overview would help to remove possible barriers so that other innovative companies can access support schemes and increase the scope of innovation in Denmark. Should there be improved cooperation between the institutions that grant funding, including, in particular, the Danish Innovation Fund and the Growth Fund? Should the Ministry of Business and Statistics Denmark create a better overview of recipients of support and the outcomes of schemes?
- Today, the incentives for universities to disseminate knowledge outside academic circles is limited. Should the recent proposals by the expert committee on results-based distribution of basic funds incorporate quantitative targets for knowledge dissemination into the individual university's contracted strategic plans and into the allocation of their basic grants? And should an increased emphasis be placed on knowledge dissemination by including requirements for knowledge dissemination to companies and citizens in the legal job specifications of academic personnel?