Smart Homes Market Study

2018 Report

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1. Introduction

This report is for startups and SMEs as well as business support organizations and other organizations that are interested in the consumer cleantech market and the smart home sector.

Smart homes solutions are based mainly on the Internet of Things (IoT) that provides the connection to everyday devices for regular consumers for more comfortable, safe, economic and entertaining living[1]. Some researchers note that the value of the smart home devices market is going to grow to 174 billion USD by 2025[2]. This technological revolution is going to bring home automation in new and innovative ways[3].

Homes will be smart because of machine learning, that is why the term “smart home” is used rather than “connected home”. “The change will happen over the next decade, as more and more devices begin to make use of machine learning, computer vision, natural language processing, and other technologies that actually are capable of thinking, making decisions, and learning”[4].

The robotization of household appliances such as vacuum cleaners or lawnmowers is an interesting development. A number of these appliances is set to rise and because of machine learning these appliances will help households – such help is especially important for people with disabilities or the elderly. The same trend applies to wearables that help to monitor everyday activities (sleep, nutrition, sports) and are connected to a data collector that might then be used to, for example, alert relevant authorities if anything bad happens[5]. The data “produced” by smart home devices might also be analyzed in order to improve everyday living conditions, such as air quality.

This means that current smart home solutions are not only about entertainment (such as wireless speaker systems or home cinema systems) but also about the quality of living in general.

These trends are at different levels of development – which is the result of diverse legal regulations, different levels of market maturity and customer readiness to absorb these innovations (including economic aspects of such absorption).

The report introduces information from eight Baltic Sea Region (BSR) countries: Estonia, Finland, Germany, Latvia, Norway (in some areas), Poland, Russia and Sweden, on legal regulations, support institutions, programmes, funding and market opportunities (including barriers, size of the markets, key customers and players) as well as on digitalization issues, especially in the smart homes sector. The perspectives of the smart home (or consumer cleantech in general) actors, namely startups/SMEs and experts from the fields of law, market and support systems (from support organizations) are also explored. The report is based on questionnaires and interviews carried out with startup/SMEs and experts from BSR countries.

[1] https://www.forbes.com/sites/bernardmarr/2020/01/13/the-5-biggest-smart-home-trends-in-2020/#9119be1389bf
[2] https://www.marketwatch.com/press-release/global-smart-home-market-size-growth-opportunity-and-forecast-to-2025-2019-11-04
[3] https://www.forbes.com/sites/bernardmarr/2020/01/13/the-5-biggest-smart-home-trends-in-2020/#9119be1389bf
[4] Ibid.
[5] Ibid.

2. Smart Homes trends

2.1 Legal regulations and strategies

Finland

Cleantech and consumer cleantech markets are well developed, and plenty of domestic and foreign technology companies do business in Finland. The business environment is appealing to a variety of green business and enables them to flourish. The Finnish government is committed to one of Europe's most ambitious sustainability goals, which speed up the growth of the cleantech sector.

In general, Finnish regulations and technical requirements follow EU regulations. However, new or changing technical regulations in different countries can create uncertainty for businesses. For example, insulation requirements for windows (U-value, etc.) are more demanding in Finland than elsewhere in the EU. There are regional differences in practices and procedures that regulate electricity trading as well as the production of renewable energy (renewable energy tends to be managed in a dispersed way, unlike centralized management of traditional energy sources).

Germany

The concept of consumer cleantech has not been fully established and the cleantech community is small. The smart home sector is particularly interesting in terms of security systems and has the potential to save energy.

Legal regulations regarding smart homes:

- Interest-free funding by KfW-Bank for a smart home
- Requirements: a smart home steering unit must be installed in between 0,8 and 1,1 m; switches must be away 0,25 m from the ceiling
- KfW funding for private investments in a smart home renovation, maximum of 50 000 EUR per household
- Three types of hiring: self-employed free agents, part-time or full-time employee, temporary workers
- EEG (renewable energy law) regulates investments in consumer cleantech and renewable energy systems
- Tax law is the same as in most countries and includes VAT, municipal trade tax, corporate tax, income tax, solidarity surcharge, but its interpretation depends on the region.

Latvia

There are no specific consumer cleantech regulations, the same rules apply as in general business and there are no specific legal regulations for smart homes.

Norway

Regulations and requirements are very similar to EU regulations but there are not many laws that focus specifically on the consumer cleantech market. Most of the existing regulations that are considered to be detrimental relate to running a company in a general sense.

Some emission regulations are beneficial to cleantech companies. This is because companies often do not reach the upper emission limits. Many major Norwegian cities have also implemented "Low Emission Zones" for transportation.

There are no specific laws or regulations regarding smart homes, but there are many building regulations that companies must follow. In addition, companies must also apply for building permits to the municipality where the building is to be constructed. This can be a lengthy process, especially if the original plan is not approved and needs to be revised. For example, simple solar panels can be installed on the roof and walls of one's home without having to apply for approval, as long as the panels follow the shape of the building. A smaller solar panel plant or solar panels that do not follow the shape of the house's exterior need to be approved. It is important to know that the rules may vary between municipalities.

Poland

There are no specific legal regulations for the consumer cleantech sector, and this also applies to smart homes solutions. Most regulations stem from EU regulations. the European Commission (EC) "Clean Energy for All Europeans" proposal stipulates that transition to clean energy is the future growth sector. The proposal covers legislation in areas such as energy efficiency, renewable energy, the design of the electricity market, security of electricity supply and governance rules for the Energy Union. Moreover, the EC rolled out a new way package of measures for eco-design and a strategy for connected and automated mobility. The measures include actions to accelerate clean energy innovation and to renovate Europe's buildings as well as drive to encourage public and private investment, promote EU industrial competitiveness and mitigate the impact of the clean energy transition on society.

The 2010 Energy Performance of Buildings Directive and the 2012 Energy Efficiency Directive promote improvements of the energy performance of buildings within the EU and providing a stable environment for investment.

On November 30, 2016, the EC updated the Energy Performance of Buildings Directive to help promote the use of smart technology in buildings, to streamline existing rules and accelerate building renovation.

Russia

In 2018, the Ministry of Construction, Housing and Utilities of the Russian Federation approved "Smart City" project which is part of the national "Housing and Urban Environment" project and the national "Digital Economy" programme – 180 cities from all territorial subjects of the federation participate in the project. The "Smart City" project sets out basic and additional processes that should be carried out by the participating cities by 2024. The standard covers eight areas of municipal government, smart housing and public utilities, urban environment innovation, smart city transport, intellectual systems of public and environmental safety, the infrastructure of communication networks, tourism and services.

Russia has the so-called "Green Construction" standards that cover private as well as a public building. The first step of building standards harmonization in terms of green construction is the Russian Federation GOST R 54964-2012 guideline "Compliance assessment. Ecological requirements for estate properties". The document sets out ecological standards for the property market. Property is considered to be part of the external environment. Other stipulations require that properties are managed in an eco-friendly way, minimize energy use and negative effects on the environment whilst looking after the user.

Sweden

The Swedish government has set ambitious environmental goals. Early implementation of environmental protection laws has been an important driver for the development of clean technologies in Sweden. The government allocates funds for innovation as a means to meet the set goals and support sustainable development.

Swedish consumer cleantech companies noted that a company registration process and the legal structure behind it is not always conducive to running an effective business.

Some companies noted that there is some flexibility in the process which has allowed them to avoid big problems, while other companies have found that this discrepancy has caused delays in their' development.

There are various building regulations controlled by a body that is responsible for ensuring that regulations and requirements are followed. As of August 2018, a building permit is no longer needed when installing solar panels that follow the shape of the building and that are in accordance with the zoning plan. Previously, the rules for building permits for solar panels varied across municipalities. It is possible to apply for government subsidies when installing solar panels[6].

Additional laws related to smart homes that should be considered are the rights and obligations of tenants or property owners, which regulate processes of subleasing or changing the exterior of the house. For insurance to be valid, some installations cannot be carried out by property owners but by an authorized professional.

When it comes to creating new services and products, startups still need to consider how their service or product relates to the already existing alternatives on the market. Legal aspects needed to be consideration include employment laws, liability and taxation in cases where private actors perform services. It is also worth considering competition with companies that provide similar services or products, but in a more traditional way for which legal regulations are often already in place.

[6] Svensk Solenergi, 2018.

2.2 Institutions, programmes and financial support

Finland

In Finland, the Centres for Economic Development, Transport and the Environment (ELY), regional development corporations of the biggest cities provide support for entrepreneurs. Additionally, Motiva, a sustainable development company funded by the state, offers, for instance, experiment opportunities for startups.

The ELY provide, e.g., consulting services and help business development and analyze the current status of business of SMEs that want to grow business.

Motiva offers a possibility to experiment with the idea of a startup. The service and digital platform offered by Motiva is called a Place to Experiment. The platform joins ideators, experimenters and coaches with funders and users.

Entrepreneurs may get support from the private sector. For instance, the Federation of Finnish Enterprises, the Finnish Business School Graduates and Finnish Enterprise Agencies support entrepreneurs in various ways. The Federation of Finnish Enterprises is an interest and service organization for SMEs, it promotes the interests of enterprises with the government but also offer services and networking opportunities for its members. The advice covers law, taxation, social security, insolvency, education, changes of ownership and environmental issues. Additionally, the Federation of Finnish Enterprises already has collaboration and cooperation networks, and so can help entrepreneurs in networking.

The Finnish Business School Graduates offers, e.g., legal advice, training and events, career coaching, guides for entrepreneurs and webinars for its entrepreneur members.

Finnish Enterprise Agencies are a nationwide network of 125 qualified business advisors and 1 500 experts – they provide counselling tailored specifically for individual businesses. Support is provided for anyone with a business idea or already existing business and is free of charge. Additionally, Finnish Enterprise Agencies offer a free Entrepreneur Guide that has information and legislative amendments, such as taxation, financing and licences for businesses, employer obligations, accounting, and pension and unemployment insurance for self-employed.

Several universities in Finland offer entrepreneurial training that helps students to start their own business. The training aims to raise entrepreneurial awareness, attitudes, behaviour and culture. For instance, the University of Turku and Aalto University offer this kind of training and education.

Aalto University works proactively to further entrepreneurship and creation of new businesses. For instance, Aalto ENT (AENT) develops educational programmes to help entrepreneurs manage their teams and companies better and to create successful commercial products and services. In the Aalto entrepreneurship ecosystem, there are multiple small actors offering acceleration services and networking, for instance, Aaltoes and Startup Sauna. Startuplifers is an internship programme that provides students with a chance to work in startups in Silicon Valley. Aalto Ventures Programme prepares students for high-growth entrepreneurship. Grid offers community spaces for startups, and Impact Iglu and Kiuas run accelerator programmes. Startup event Slush and hackathon Junction also stem from AENT.

Some examples of Finnish accelerators and incubators:

- Avanto Ventures – Startup programmes, venture building, strategy and business design, matchmaking, investments[7]
- Cleantech Finland – The hub of Finnish cleantech expertise and sustainable innovations[8]
- Finnvera – Provides financing for the start, growth and internationalization of enterprises and protection against export risks[9]
- Loudspring – Competences, industrial partnership and capital for businesses focused on generating clean energy and creating solutions for efficient natural resource use[10]
- NewCo Helsinki – Business advisory support, startup services[11]
- Nordic Innovation Accelerator – International cleantech business network, connects innovations with market opportunities and funding[12]

In terms of financial support, there are the following funding options: own funding, loan funding, investments, crowdfunding and public funding. An entrepreneur may fund their business through equity and external capital. Banks are the main financiers of SMEs, nearly 80% of SMEs reported that they applied to banks for funding. Loan financing is granted mainly by commercial banks and a financing company, Finnvera, which offers expertise and funding for the different phases of business development. For SMEs, Finnvera can offer funding, e.g., in collaboration with a bank, or supplement funding provided by a bank by offering loan or a guarantee for the loan.

Enterprises can get funding from capital investors, such as business angels or capital investment companies.

Crowdfunding is one option and, in general, it is a good option for a company that aims to grow or launch a new product. Usually, crowdfunding is sought through a platform provided by a crowdfunding broker. There are different options for crowdfunding such as crowdfunding based on equity, debt, and advance sales, investment type and loan-type crowdfunding.

There are also options for public funding support. A startup may receive support for its development from, for instance, the ELY and Business Finland. Support is provided especially for growth and internationalization. Additionally, Employment and Economic Development Office (TE-office) provides startup grants.-TE-office provides startup grants and offers development services for entrepreneurs who have received a startup grant. Application for the grant includes a business plan, profitability and funding calculations, and a certificate of the payment of taxes.

Other funding opportunities are provided by Business Finland[13].

Germany

There are many ways to find support for startups and founders, for example networks such as “Für-Gründer” or “Gründernetzwerk” and governmental aid agencies, which help startups organize themselves, build a scalable strategy, and find venture capital (VC) or supporters as well as starting cooperation with other organizations. The Association of German Chambers of Industry and Commerce (IHK) is present in major cities and often is the first port of call for companies looking for funding. The support, programmes or development support models vary by region and the business field in which an

[7] http://avantoventures.com/
[8] http://www.cleantechfinland.com/what-s-cleantech-finland
[9] https://www.finnvera.fi/eng/
[10] http://loudspring.earth/
[11] https://newcohelsinki.fi/en/
[12] https://www.nordicinnovationaccelerator.com/
[13] www.businessfinland.fi/en/

enterprise operates. German states, companies, universities, NGOs and public authorities initiate such programmes. Often support is only available for a certain industry, sector or regional members.

Incubators offer mentoring, financing and certain infrastructure. Regularly, the relationship between founders and sponsors is much closer in a startup incubator than in an accelerator. However, startups often have to hand over more shares and some influence to their sponsors.

There are also many existing coworking spaces like the Factory in Berlin, an interface between incubation, acceleration, launching and innovation, and operation. Coworking spaces exist all over Germany and serve as a meeting point in the German startup culture.

Municipalities, cities, regions and states offer business support in various ways. In most cities, a weekly “Stammtisch” a meeting of entrepreneurs takes place, where regional partners and contacts find each other. Networks, like the “Gründernetzwerk Thüringen”, support graduates and connect them to the regional economy, which can lead to seeding, creating, collaboration as well as to multilateral transfers of knowledge and technology.

Most of these intensive startups programmes have financial subsidies, office space, further training opportunities and mentoring at their disposal. These subsidies are for new startups focused on information and communication technology (ICT). The number of hardware startups or founders from the health, music and energy sectors is growing. The main criterium to get the support of an accelerator is high market potential. Many accelerators target a specific sector or startup at a particular stage of development, which leads to fruitful collaborations. Most of the accelerators, i.e. Axel Springer Plug N Play, the Berlin Startup Academy, HubRaum, German Accelerator are profit oriented. But other accelerators, like Climate KIC, EIT Digital Accelerator, are not.

There are several funding opportunities. Some serve specific fields like fintech or renewable tech other serve startups from all sectors. Supportive structures like EXIST, HORIZON 2020 or GRW are funding instruments established by public authorities, which want to increase the number of businesses founded in their region or boost a particular sector or cause which they value. Venture capital, business angels are profit oriented.

Crowdfunding has become an immensely popular tool to finance startups. Germans are likely to invest in non-profit organizations (NGOs) and support aid causes this way. Trust and transparency need to be established with potential investors when crowdfunding.

Governmental support structures like EXIST help startups by providing a wage to founders for the first year and providing office space for startups.

Latvia

Investment and Development Agency of Latvia, a state-owned development finance institution Altum, and two of the biggest universities, Riga Technical University (RTU) and the University of Latvia (UL) are the main players offering public institutional support. Another active player is the Startup Association.

There are several support tools, such as accelerators, namely, Startup Wise Guys, BuildIT, Overkill and Commercialization Reactor.

The two biggest universities in Latvia have business incubators and encourage students to start their first business while they are still studying. Since 2017, the UL Student Business Incubator runs a pre-acceleration programme for startups focused on blockchain.

Students Business Incubator from RTU or “IdeLab” supports technology-intensive startups focused on greentech and different hardware devices. RTU is the partner of Climate KIC and is responsible for managing its activity in Latvia. Both student incubators offer mentorship, organize boot camps and give access to a prototyping studio.

There are also business incubators at private universities – in Riga, there are at least six.

Public funding from different support programmes is available for startups and SMEs, a big part of which is managed by the Investment and Development Agency of Latvia (LIAA) and state-owned development finance institution ALTUM. For early-stage startups and ones just starting their first venture, LIAA has business incubators across Latvia and participants of these incubators can apply for grants to pay for services or equipment they need. The requirement is that startups or SMEs have to finance 50% of the needed amount and the maximum amount they can receive in the form of grants is 10 000 EUR. ALTUM provides loans and credit guarantees, offers insurance for business export deals and investment to VC funds.

Most of the publicly available funding comes from different EU funds. For example, for the 2014-2020 planning period, 195M EUR from EU funds has been allocated for innovation development.

There are also private investment organizations, such as the Latvian Business Angel Network, which organizes investment sessions every month. Different VC funds are present in Latvia and the Baltic region, as in other countries, these VC funds are looking for technology startups with global growth potential.

Norway

Grundr specializes in startup needs and offers entrepreneurs access to networks, through hosting events and creating an overview of the ecosystem. It also offers business advice on pitching, management and other services.

IKT Norge is an association for different size players in the ICT field. For startups younger than five years and with a revenue of less than 10 millon NOK, there is the Startup Forum. The forum provides access to a network of more established companies within the ICT sector that can offer information and share their experiences, but these companies might be also be interested in new technologies developed by startups.

Another private initiative is The Hub which is a platform that focuses on startups - The Hub's first target group. People wanting to join startups are its second target group.

Public support institutions, for example is Siva – its purpose is to support innovation and business development in Norway. It has stakes/shares in many Norwegian incubators and creates an innovation-friendly environment. Its website is called Effekten and it maps out the geographical location of incubators and clusters as well as listing ownership of companies and companies linked to different organizations[14].

Innovation Norway is another state-run organization that supports SMEs and provides mentoring for startups. It also helps with business development, internationalization and finding potential investors. Established companies that use innovative technologies that have not been implemented can apply for support from a governmental institution called, ENOVA - it is run by the Ministry of Climate and Environment and works on sustainable solutions such as energy and climate technology. This could provide indirect support to startups that have solutions that are interesting for large companies and consumers as well as startups that are interested in implementing proof of concept.

The Norwegian School of Entrepreneurship supports students in the field of entrepreneurship. All Norwegian universities and colleges are involved in entrepreneurship programmes. During their education, students work in tech startups for three months and gain practical skills and understanding. The Norwegian School of Science and Technology has an entrepreneurial master's degree. Students get to develop their own business ideas and have access to the school's network, incubator, workspace and mentorship during the degree.

[14] http://effekten.siva.no/

For startups looking for accelerators, co-working spaces, funding and other types of support, Oslo Business Region has provided the "Oslo Startup Map"[15]. There are also acceleration programmes dedicated to high tech startups, such as:

- Startup Lab – Accelerator for tech startups
- Katapult Accelerator – a programme for tech companies working in IoT, AI, blockchain with a focus on clean energy, resource efficiency, smart cities and circular economy
- Techstars Energy Accelerator – for innovative solutions within the energy sector (oil and gas); new business models, digitalization and renewables
- Angel Challenge – Entrepreneur and venture investors offer business support, available in different locations in Norway.

Crowdfunding is another option, for example, a local crowdfunding platform for different kinds of projects is called Bidra. There are also business angel networks and associations. For example, Business Angels Norway, which hosts monthly networking events for startups, and investors interested in green investments.

There are several private funding sites via business angels:

- NorBan[16]
- Network for business angels Angel Challenge[17]
- DNB NXT[18].

Innovation Norway provides grants for startups. For example, for market evaluation startups can receive 50 000 - 100 000 NOK. Its activities include customer surveys, testing and development of solution as well as networking and competence building.

Poland

In Poland, organizations that focus on the cleantech sector are Climate KIC Poland, South Poland Cleantech Cluster, EIT Innoenergy UN Global Contact Poland, The Polish Economic Chamber of Renewable Distributed Energy, Startup Spark – the range of their activities is broader than smart homes as they focus on environmental issues in general.

Other organizations that support innovative startups also include consumer cleantech startups. The support is provided by public support organizations, such as Polish Agency for Enterprise Development, Polish Development Fund Group (PFR), technology parks, science and technology parks, incubators, accelerators, and NGOs (e.g. Foundation for Technology Entrepreneurship).

There is a growing number of programmes and projects that provide financial support for startups. Most of the funding comes from EU funds, through the PFR. The Polish Agency for Enterprise Development is part of the PFR, and this particular institution provides financial instruments such as:

- Starter Platforms
- SME Internationalization
- Innovation Vouchers
- Erasmus for young entrepreneurs
- Scaleup acceleration programmes

[15] http://www.oslobusinessregion.no/startup-in-oslo/oslo-startup-map/
[16] http://www.norban.no/
[17] http://angelchallenge.com/
[18] https://startupmatcher.com/nxt

PFR Ventures, also part of the PFR, together with the National Centre for Research and Development provide financial support for the creation of VCs. The centre offers programmes for startup development and within its Operational Programmes it offers Smart Growth, Digital Poland, Innovative Economy, Infrastructure and Environment, Human Capital and Fast Track[19]. Within the Infrastructure and Environment Operational Programme, 15 priority axes are being implemented, including:

- Water and wastewater management
- Waste management and land protection and rehabilitation
- Resource management and environmental risk prevention
- Nature conservation and environmental awareness building
- Initiatives aimed at helping enterprises meet environmental requirements

Russia

One of the support organizations in Russia is an international consortium called, the St. Petersburg Cleantech Cluster for the Urban Environment. At this moment (at the time of writing of this report) there are 62 members in the cluster. The members have agreed to work together in order to achieve shared goals by defining effective mechanisms for interaction between business, public authorities, education and science institutions.

The cluster organizes and implements joint programmes and projects (cluster projects) by standardizing information, technology and financial resources of all members as well as by gaining external funding in the following subject areas:

- Saving of Energy Resources
- Energy Efficiency
- Smart City/Smart Grid
- Green Building/Ecohouse
- Waste Management
- City Transport
- IT for Cleantech
- Clean Industrial Processes in an Urban Environment
- Biofuel
- Solar and Wind Energy

Public support institutions, such as funds that assist small enterprises that focus on science and technology also offer funding and their main tasks are as follows:

- provision of direct financial support and information for small innovative enterprises
- creation and development of supporting infrastructure for innovative SMEs
- promoting the creation of new jobs that are based on the scientific and technical potential of the country
- attracting investment to small innovative enterprises
- training (including the involvement of youth in innovative activities).

Another organization supporting startups is the Fund of Innovations, founded in 2018 by 46 enterprises from St. Petersburg.

[19] https://www.ncbr.gov.pl/en/programmes/european-funds/innovative-economy-operational-programme/

There is also the Skolkovo Foundation – the agency responsible for the Russian Skolkovo Innovation Centre. The foundation aims to create conditions conducive to innovation by enabling collaboration between scientists, designers, engineers, businesspeople and people who took part in educational projects so they can introduce new technologies into the Russian economy.

The aim of the Industrial Development Fund of the Russian Federation (IDF) is to promote the implementation of the state policy in areas of science, R&D and innovation. For this purpose, the fund provides Russian organizations with financial and advisory support in the implementation of scientific and technical projects, and experimental development, including international technical and scientific cooperation.

Business incubator Ingria is a structural subdivision of a joint-stock company (JSC) "Technopark of St. Petersburg", which helps tech entrepreneurs to develop innovative projects, to test their business models and to enter international markets.

Private funding is available through VCs or business angels. In Russia, companies can raise external investments for innovative projects by attracting private and/or governmental funding. Governmental investments and investment with some state participation have a significant share of the market, which is represented by major corporations:

- The Fund of Assistance to the Development of Small Forms of Enterprises in the Scientific-technical Sphere (sic)
- Foundation for Development of the Centre for Elaboration and Commercialization of New Technologies "SKOLKOVO"
- Industry Development Fund of the Russian Federation (IDF)
- RUSNANO
- Russian Venture Company
- Rostec State Corporation.

Sweden

Connect is an initiative, and an accelerator, where people with relevant skills from universities or enterprises share their experiences and connections. Growing companies discuss their ideas and get advice on their business plans, for example.

Support is available from numerous associations that focus on cleantech, innovation and sustainability. Stockholm Cleantech is one such example, it offers coaching and network contacts for cleantech companies. More information about such associations and can be found on the website Association of Swedish Environmental Technology Industries (ASSET) – it is an umbrella organization focused on cleantech – it can also provide relevant contacts for internationalization.

Young Entrepreneurs of Sweden (YEOS), is an organization that aims to build networks and support young entrepreneurs. YEOS host entrepreneurial events and has partners that can provide expert advice. Another network is called Företagarna, it operates nationwide through 250 local associations and helps companies with legal issues, insurance and economics as well as hosting events. It also supports its members with discounts for recruiting employees via particular recruitment companies, buying vehicles and so on.

In terms of private actors, the Swedish bank SEB hosts a pop-up store where selected startups sell their products or services a couple of weeks before Christmas. Support is also provided by private companies within the building, telecommunications and household appliances sectors, in some instances through sponsorship or active involvement in projects but also through direct support in the development of new solutions by startups[20].

[20] Electrolux, 2018; Raybased, n.d. DI Digital, 2018.

Sweden's Innovation Agency supports SMEs in a variety of ways, for example, by providing opportunities to develop prototypes, business ideas and strategies, or by formulating ideas for collaboration and exchanges between different sectors or across borders.

The Swedish Energy Agency supports companies of different sizes. Its target companies working in renewable energy, stable supply and energy efficiency fields. The agency offers these companies market validation or pilot testing. Further support consists of energy advisors that provide information about energy costs, governmental grants within the energy field and more. The agency also has several support projects which are managed by the Swedish Environmental Research Institute. The agency also has an investment and export platform initiative Smart City Sweden which offers support to companies that want to establish themselves in Sweden.

Support for Swedish SMEs to reach new markets as well as foreign companies wanting to invest or expand in Sweden is provided by Business Sweden – which is partly owned by the state and has offices in more than 50 countries.

Information from governmental agencies such as the Swedish Tax Agency, the Swedish Companies Registration Office and the Swedish Agency for Economic and Regional Growth is available from one website[21].

Stockholm School of Entrepreneurship (SSES) is a collaborative project of five leading universities in Stockholm. They offer entrepreneurship courses and encourage students to work in an interdisciplinary way. The aim of SSES is to boost creativity and innovation.

Chalmers Ventures is a top-ranked business incubator managed by the Chalmers University of Technology. It offers programmes in entrepreneurship, and the incubator is seen as valuable in creating an innovative and entrepreneur-friendly environment for students. Students doing entrepreneurship degrees can start their own companies and develop ideas using input from the university. Interestingly, the university describes itself as a testbed for entrepreneurial thinking. Chalmers Ventures offers investments, coaching, events and support in the commercialization of research results for startups founded by students and researchers as well as for external parties.

GU Ventures is managed by Gothenburg University and works with business ideas that are related to a wide range of scientific fields within which the university is active.

There are Swedish incubators that are affiliated with universities, which means that incubators collaborate with one or several universities. For example, Uppsala Innovation Centre and Arctic Business Incubator. Uppsala University students and researchers get help in developing their ideas through Uppsala Innovation Centre and financial support through Uppsala University Holding.

There is a website that gathers information about testbeds in Sweden. The testbeds are categorized into a laboratory, simulated and real environments[22].

Swedish Incubators and Science Parks (SISP)[23] have 65 members that run around 80 centres. SISP have a website where they collect lists of science parks and incubators as well as share information about new project initiatives for innovation.

Swedish Cleantech is a website run by the Swedish Agency for Economic and Regional Growth[24].

Below is a list of the many acceleration programmes and incubators operating in Sweden:

- IKEA Bootcamp
- Cleantech Scandinavia
- Uminova Innovation

[21] https://www.verksamt.se/en/web/international
[22] https://swedishtestbeds.com/en/home/
[23] https://www.sisp.se/
[24] https://swedishcleantech.com/

- Chalmers Ventures, Green tech
- Sting Incubate

In terms of funding support, private funding is available through VCs such as Creandum, Industrifonden and Moor Capital, or business angels such as Stockholm Business Angels. The Swedish Venture Capital Association notes that VC funding is relatively unusual and more common for companies in the tech industry.

Crowdfunding is another means of attaining funding. The Swedish Agency for Economic and Regional Growth as well as Sweden's Innovation Agency are the public funding bodies. For example, Almi Invest is a government-run agency which lends money. In relation to private banks, Almi Invest charges a higher interest rate in order to avoid competing with banks. Most commonly, Almi Invest supports companies that also finance their business through bank loans, it specifically invests in greentech companies at the early developmental stage.

2.3 Market opportunities

Finland

The customer cleantech market is small as the country is small. However, Finland is a cleantech-friendly country, clean technologies are emphasized in the governmental programme for 2015-2019 and cleantech is one of the most important export sectors. Additionally, Finland is cold, so there is a demand for energy-efficient solutions. Most Finns are also worried about climate change, respect nature and are aware of the current environmental challenges. Thus, there is a rising interest in green solutions in the field of housing.

In the Finnish cleantech market, multiple small actors produce solutions for a single sector of housing, such as lightning or energy consumption. Comprehensive, holistic solutions for an entire building are still missing, although there is a lot of energy-efficiency and digital expertise in Finland.

Finland is one of the leading countries in the field of cleantech as there is wide political support for promoting cleantech in Finland. For instance, bioeconomy, clean technologies and digitalization are emphasized in the governmental programme for 2015-2019, and the Finnish Ministry of the Environment has focused on energy-efficiency of building renovation and construction. Additionally, cleantech is one of the most important export sectors.

There is a lot of interest in cleantech solutions. For instance, in the field of construction, there is a rising interest in energy production and storage.

In Finland, improving experimentation culture is mentioned in governmental programmes, there are already 1000 testbeds and at least 70 of them are focused on cleantech. For example:

- Forum Virium
- Smart Otaniemi
- Smart Tampere
- Åland Smart Energy Platform
- HEILA

Finland has a population of 5,5 million people and approximately 2,9 million of residential buildings. The property market has grown by about 30 000 new residential buildings per year. However, in 2017 45 000 properties were built and are built mainly in the 14 major urban areas. The 60s, 70s, and 80s saw the largest number of residential buildings being built. In Finnish houses, both heating and cooling have to be taken into account because of the country's climate but at the moment, these residential buildings are far from being energy efficient. What is more, on average, 33% of the carbon footprint comes from residential buildings.

The main actors in the Finnish cleantech business focus on resource efficiency in industrial processes, such as energy and material and water usage. Almost 60% of Finnish cleantech companies work with energy efficiency solutions, with more than one-third of the sales in the field.

In customer cleantech, there are only small actors but there are plenty of them. These consumer cleantech companies have technical expertise and know-how in monitoring health and homes. The consumer cleantech market is scattered because it has many small producers. Some examples of smart home companies/startups: There, Optiwatti, Fourdeg, Ouman, One1, BaseN, Homie, Leanheat.

There is a lot of demand for sustainable products and services in Finland and people are more interested in tracking their energy and water consumption. There is a group of consumers that is especially interested in smart home solutions. This group is more worried about climate change than an average Finn and they are more aware of the environmental issues.

Big international companies, such as Google, Apple and Ikea, only offer solutions for certain sectors of smart homes (such as lightning). Thus, in Finland, there are no comprehensive or holistic solutions or systems offered by the big actors in the market.

Germany

The smart home field is an important step towards energy-saving technology and culture. Currently, the revenue from the smart home market amounts to €2,845m in 2018 and is expected to show an annual growth rate (CAGR 2018-2023) of 20.5%, resulting in a market volume of 7,233 million EUR by 2023.

A key contact to make, when looking for financing as a startup specializing in smart homes solutions, is the SmartHome Initiative Deutschland which shares experience, information and business contacts. Homeandsmart.de is a leading media channel for smart homes and smart devices. It runs an online shop that sells smart home and IoT devices, but its main advantage is that it enables publishing of articles about smart home.

The acceptance of smart home products is increasing, and companies are beginning to recognize the high growth potential of the smart home market. The Smarthomekongress is a conference that takes place once a year in Nürnberg. It offers a network platform with talks and trade expo as well as interactive expert rounds and working sessions. Participants can identify market opportunities and gain a competitive advantage that brings economic benefits and leads to success on the market.

Germany is home to many businesses ranging from small sole traders to large conglomerates. The reason why the German economy is prominent on the world's stage are its SMEs. The government is very open to the establishment of all types of businesses, regardless of whether they involve Germans or foreigners.

By looking at the megatrends of the German market, digitalization, security, neo-ecology and connectivity bring big potential for the development of business models. These megatrends relate to the smart home market. By connecting existing technologies and businesses with disruptive models and ideas, market entry can lead to a successful diffusion.

Another major disruption is happening in the energy sector. Germany's energy transformation, or Energiewende, is seen as a role model for the move towards a carbon-neutral energy supply. The process of reshaping German energy system has already started in the 1990s when it was decided to switch from largely carbon-neutral, albeit intermittently, to renewable sources. In 2011, the government decided to phase out its nuclear power plants by 2022. In 2016, approximately a third of Germany's electricity consumption was generated by renewable technology.

Latvia

LIAA supports companies at different stages of development and supports the creation of three new acceleration programmes in Latvia. For foreign founders, there is a webpage[25], which promotes Latvia as a good place to start their business.

According to the World Bank Doing Business 2018 report, out of 109 countries, Latvia ranks as the 19th most favourable place to do business (7th amongst all of the EU member states)[26].

The smart home market is relatively new in Latvia, thus there is no publicly available accurate data or research on its size. However, since the big service providers Elektrum (Latvenergo) and TeT (Lattelecom), have started to offer smart home solutions, it is predicted that the market size should see steady growth in the coming years.

[25] https://startuplatvia.eu/
[26]https://www.doingbusiness.org/content/dam/doingBusiness/media/Annual-Reports/English/DB2018-Full-Report.pdf

The TeT forecast is that by 2020, almost 30% of all households in Latvia will be equipped with smart home solutions. However, the data from statista.com, suggest that only 22% of households will have smart home solutions in Latvia by 2023 when the market value will be around 60 million EUR[27].

A company called Echoo offers smart home solutions, but it provides one brand devices (not a white label solution), and thus it could be harder for new startups to collaborate with Echoo and use it as a sales channel.

Some companies provide services for end-customers and some companies develop and manufacture smart devices. For example, Istabai, founded in 2012, offers a full range of devices for smart home solutions with partners in, and outside of, Latvia. Another company, much younger, but also with big ambitions, is a company called Mazzy. The company tries to disrupt the energy metering industry with its IoT solution.

Depending on the companies' core business, different business models are used by companies which are in the smart home sector. There are service providers, which focus on B2C models, while companies which create their own solutions and devices, sell most of their products through other companies focusing on B2B models.

Norway

Norway is number eight according to the Ease of Doing Business Index ranking[28]. It directs the most resources towards driving cleantech innovation through R&D.

The revenue for the Norwegian smart homes market, including energy management and smart appliances as well as consumer cleantech-related fields such as security solutions, is expected to grow at a rate of 15,7% per year. It is expected that the percentage of households using smart home solutions will be between 31,6% and 52,5% by 2022[29]. As Norway has high levels of interpersonal trust, it is not surprising that the use of IoT and similar solutions are also high.

In a survey called the Sustainable Brand Index, consumer attitudes towards sustainable brands were studied in Norway, Finland, Denmark and Sweden. Norway was the country where consumers were least likely to say that sustainability impacts their purchases. And it has the largest number of consumers who find sustainability to be less important in general[30].

Importantly, Norwegians are spending an increasing amount of their total budget on housing[31] and it looks like Norway will become an important market in home automation[32]. The deregulated power system could be improved by using smart metering in terms of measuring the exact electricity consumption and reducing prices, to name a few examples[33]. By the end of 2018, for instance, Norway's largest electrical company introduced its new smart energy devices to 700 000 customers[34]. This development allows consumers to learn more about their energy use and this drives the demand for smart home appliances and devices.

The concept of smart city is gaining ground. For example, Futurebuilt is a project in which municipalities, the National Office of Building Technology and Administration, the Green Building Alliance and the National Association of Norwegian Architects have come together to support climate-friendly urban development. The ten-year project will be finished by 2020, its aim is to establish carbon-neutral urban areas and to inspire future development within this field[35]. By working with a circular economy,

[27] https://www.statista.com
[28] The World Bank, 2018a.
[29] Statista, 2018.
[30] SB Insight, 2018.
[31] Statistisk Sentralbyrå, 2016.
[32] NVE, 2017.
[33] Buccella, Cecati, Ergut, Gungor, Hancke, Kocak & Sahin, 2012.
[34] Aidon, 2017.
[35] FutureBuilt, 2016a.

renewable energy and new materials[36], fields related to consumer cleantech can gain new ground. Thus, potentially making this project an important player in the smart home sector.

Other initiatives relevant to consumer cleantech, are projects related to solutions of consumer-cleantech companies. IoT is one such field, the IoT ProtoLab in Trondheim works on the development of a new technology forum open to entrepreneurs[37]. The Norwegian region Trøndelag, together with two Swedish municipalities, has joined a project called SMICE where the aim is to support circular economy solutions[38]. There are also governmental initiatives that support shared economy solutions, mainly through developing recommendations for taxation and deregulation.

Poland

The smart homes market in Poland is at its growth stage. More companies sell smart homes solutions, using both in B2B and B2C models. The green building construction market is part of the smart home sector. Green building construction means that projects are certified by a globally recognized green rating system. The growth stage is dominated by the commercial sector and is motivated by business benefits. This shows that Poland is interested in making buildings more environmentally friendly and is indicative of growth in the cleantech sector, which is mostly driven by consumer demand and new commercial buildings being build.

Growing trends are also seen in the field of indoor air quality hardware and software. The demand for improving air quality in workplaces will grow as the market matures and is able to prove its cost-benefit analysis. Growing health awareness amongst consumers and the rising numbers of respiratory and cardiovascular diseases due to pollution is driving the consumer market.

Solar panels and flat plate solar collector markets are also becoming more popular, especially because of a financial support programme that provides subsidies for households that decide to install such panels. The solar power market is developing at a steady and sustainable pace. Simplified grid-connection conditions for installation of up to 40kW, the so-called umbrella residential projects, various local subsidy schemes and most importantly a net metering discount system are driving market dispersion. The residential solar market connected 81.3 MW of solar panels to the grid in 2017, most of which were installed in eastern and southern Poland. The total number of installations at the end of 2017 was 27,310, accounting for 172.5 MW. When measured like this, capacity added in 2017 is the highest ever recorded in the Polish residential market[39]. Solar panels account for just 0.4% of the total energy mix of Poland which, according to SPF Polska PV, is 43.3 GW. The country's aim is that renewable energy will reach 15% by 2020[40].

Poland is infamous in Europe and outside of Europe because approximately 90% of the country's electricity comes from coal and the coal lobby is hugely powerful. However, this has been gradually changing, also, to low-cost solar and wind energy[41].

Some examples of cleantech companies in Poland:

- EcoLife – produces air sensors and pollution monitors, collects all information on a data cloud, in order to analyze and prepare individual recommendations
- Tegeos – constructs research and measurement devices for measuring electrical currents and temperature of different materials. Also, builds waste-heat recovery systems
- Euvic Energia – creates IT systems for billing, payment, and management of energy for large building owners

[36] FutureBuilt, 2016b.
[37] Knudsen, 2018.
[38] SMICE, 2017.
[39] http://taiyangnews.info/markets/polish-residential-pv-capacity-tops-172-mw/
[40] Ibid.
[41] https://cleantechnica.com/page/2/?s=poland

- Every European Digital – helps with consulting as well as design or distribution for IoT companies throughout Europe
- Grinfinity – software that helps with energy management for machines, factories or companies
- Lerta – a company developing modern technological solutions for the energy sector; offers energy sellers support in business digitalization and development as well as in tailoring their offer by providing expert metering and analysis system. In 2016, it was recognized by experts and investors from Silicon Valley as one of the top 30 technological companies in the world creating solutions for the energy sector
- Lesss – builds energy-saving systems for public lighting
- Plantalux – develops innovative agriculture lighting
- Prognosis – energy management software for businesses
- pSenso – remote control, monitoring and alarm functionality for home appliances and electrical functions. Can help save energy
- rotoby – innovations in wind turbine blades
- Solace – builds small, solar-powered, environmentally sustainable, affordable and functional homes
- iNergy – heating, cooling and ventilation in an energy-efficient system for homes and offices
- VPPlant – software solutions for optimizing energy consumption in large volume buildings

Russia

In 2008 the government announced a programme for raising the energy efficiency in the Russian economy. One of the main objectives was to reduce energy consumption by 40% by 2020. The basic methods of reducing energy consumption are installation of power supply meters in industrial facilities and the private sector as well as replacing traditional lighting systems with energy-saving ones.

Generally speaking, the clean technology industry is still at the early stage of commercialization of its cumulative scientific potential. Because of governmental support, which is connected to nanotechnology and energy efficiency programmes, Russian and foreign initiators have significant opportunities to deliver their projects.

Greentech investment possibilities will generate interest of Russian enterprises in this technology. This will promote the transfer of green technologies from abroad and more companies will implement such solutions[42].

The market analysis of smart home systems by Discovery Research Group showed, that 47% of house buyers show interest in this technology and 32% are ready to pay for it. Experts from J'son & Partners Consulting estimate the current value of the market to be 7-10 billion RUB. According to forecasts, within the next five years, the number of households using this technology will grow to 2.8 million[43]. In the last ten years, the price of smart home technologies has gone down by threefold – this trend is set to continue but is dependent on the development of the IoT. For now, the IoT is used in a fragmented way.

In terms of demand for, and supply of, green projects, there are two main players, the public and private sector institutions and organizations. Both players could stimulate the development of the green finance market and promote more responsible investing focused on environmental protection and resource performance in sectors which were unable to implement the green investment model. Public institutions include the Ministry of Finance, Ministry of Economic Development, Central Bank, sectoral ministries (Ministry of Energy, etc.) and state development banks. On the private sector side, the banking sector (investment banks, commercial banks) leads and involves institutional investors, corporations and SMEs.

[42] http://www.nanonewsnet.ru/files/cleandex_cleantech_in_russia_2010.pdf
[43] J'son & Partners Consulting.

Businesses are often misaligned with social objectives of sustainable development, exacerbating social exclusion and environmental degradation. Greater attention to promoting environmental and socially responsible production in resource-based industries could change behaviours. There are examples of companies willing to work towards sustainable development, but they lack good interfaces to work with the public sector. Around the world, a variety of tax and subsidy breaks are used to provide incentives for businesses. Countries with supportive regulatory and tax environments attract more green investors and tend to offer more financing options. To leverage the effect of fiscal measures on green finance, Russian authorities could promote green public procurement. Green public procurement requires that environmental performance considerations are embedded in governmental procurement decision-making processes in the same way as price, performance, quality and availability are already embedded[44].

Sweden

In 2017, Sweden, out of the all EU member states, ranked as number one in the Eco-Innovation Business Index and also ranked as the leader (first place) of European innovation[45]. Generally, Sweden can be considered a progressive country when it comes to technology and people, businesses and government's attitudes towards this development[46].

The size of the market for innovation within smart homes can be better understood by mapping the development of possible solutions within the field. The market for IoT solutions, for instance, is growing fast in the Nordic countries, in general. An important aspect of the future development in the Nordics is that it is expected that an average number of connected devices per person will be to up to six units by 2021. Interestingly in 2017, that average was already four times the global average. It is further expected that applications for electronic devices will be an important driver of growth within the smart homes sector, which in turn is expected to be one of the two largest drivers of IoT solutions, in general, over the coming few years[47]. The revenue of the Swedish smart homes market is expected to be 554 million dollars in 2018 with the expected annual growth rate of 17,9 %. The number of smart homes is expected to increase from 22,3% in 2018 to 37,8% in 2022. These figures include consumer cleantech solutions such as energy management and smart appliances as well as security solutions[48].

From 2011, surveys mapping consumer perspectives on sustainability and brands have been conducted in countries in Northern Europe. This independent study called the Sustainable Brand Index reveals that Swedish consumers find sections of the UN Sustainable Development Goals are the most important and should be implemented by companies[49]. This could present consumer cleantech companies with opportunities. According to the study conducted in 2017, Swedes are more likely to consider climate change to be a big problem and are willing to make changes in their everyday lives in order to address this problem in comparison the EU average. Swedes also consider it to be important that government takes action to increase the use of renewables.

Governmental support for Swedish innovation, technological development, as well as sustainable development, is a potential driver for the further development of the consumer cleantech sector. One such example is the founding of the National Innovation Council in 2015 by the Swedish government.

Key actors in the innovation ecosystem include governmental initiatives or agencies. Additional examples are Sweden's Innovation Agency Vinnova and Swedish Agency for Economic and Regional

[44] http://documents1.worldbank.org/curated/en/103531540924946297/pdf/131516-PN-P168296-P164837-PUBLIC-Green-finance-Note.pdf
[45] European Commission, 2018.
[46] Telia & Arthur D Little, 2017.
[47] Telia & Arthur D Little, 2017.
[48] Statista, 2018.
[49] https://sdgs.un.org/goals

Growth, which also support entrepreneurship and innovation through R&D funding or grants for companies with projects developing IoT, circular economy and so on[50].

Irrespective of a company size, the number of companies offering services and products that focus on environmental aspects had increased between 2014 and 2017[51]. When it comes to properties, traditional building management systems are most common. However, smart solutions have been developed and these enable data collection using sensors, connectivity and analysis. Consumer demand and the level of technological advancement signals that future development of building automation in Sweden can be quick, and the first steps to include innovative solutions from the construction phase have already taken place.

[50] Vinnova, n.d., Vinnova 2018, Swedish Agency for Economic and Regional Growth n.d.
[51] Swedish Agency for Economic and Regional Growth, 2018b

2.5 Two perspectives: Experts and smartups/SMEs

2.5.1 Methodology

Two groups of respondents were studies, 1) startups/SMEs and 2) experts from legal regulations, support system and business development fields.

Startups completed an online questionnaire and experts were interviewed by the representatives of each country taking part in the project.

The questionnaire for startups/SMEs consisted of four parts:

1. Company's profile and product/service details (how it is financed, how advanced is the product/service, is it making money, customer profile, etc.).
2. Smart home legislation (starting a business, ease of doing business, financial solutions/instruments available, employment regulations, etc.).
3. Support system (the most efficient support instruments, the expected support outcome).
4. Business development (market and customers, level of market share, competition, participation in entrepreneurial networks and events, expectations towards accelerators).

Semi-structured in-depth interviews were carried out with the experts.

1. Legal regulations
   - basic smart home regulations
   - critical conditions for doing business in the smart home sector (stimulating, inhibiting)
2. Support system
   1. support conditions for startups and SMEs
   2. support processes and instruments (preincubation, incubation, acceleration, technology transfer)
   3. funding sources
3. Business development
   - market trends in the smart home sector (drivers and barriers)
   - market opportunities for startups and SMEs (size and structure of the market, key customers and players, business models and solutions, investment trends)

In the results section, an overview of each country is provided.

2.5.2 Results

Finland

Startups and SMEs

Startups and SMEs find it relatively easy to establish and run a business in Finland. There is plenty of information and support publicly available.

The advantages of Finland's business and legal regulations as seen by the startups:

- Finland is very advanced.
- plenty of support available, one just needs to know where to look
- universal rules and procedures secure fair treatment
- no corruption

According to the interviewed startups, business and legal regulations could be improved by the following:

- bureaucracy needs to be streamlined for startups
- lowering obligatory fees and taxes for the first year of business or establishing a retrospective fee collected once a company has made profits
- easing the process of finding a suitable accountant
- providing publicly funded (free) support and consultation on legal, finance and investment issues and opportunities
- ensuring that building regulation provide the same opportunities for SMEs and established companies with innovative technologies and services

In the case of business support, the interviewed startups said that slow processes of new partners, such as larger companies, can hinder startups' activity. If a startup collaborates with a large company, it may face difficulties in negotiating contracts. According to the interviewed startups, larger companies have the power to control the process.

Cities are slow in implementing their own strategies and making decisions. Although, they have clear climate targets and strategies, the lack of profit and the loss of responsibility slows down processes. The problem is also that the decision-makers only focus on a yearly budget so experiments and pilots may be implemented but large-scale solutions are not. Additionally, there are no programmes which could help startups collaborate with cities.

In general, startups reported that there is plenty of help available for starting and running a business, and Finland is seen as an advanced environment to start and run a business. The interviewed startups were mainly funded by grants from Tekes/Business Finland, loans, investors, business angels and VCs. The only thing that startups found challenging was that they have to apply for help to different organizations.

Experts

Currently (at the time of writing this report), there is a discussion on carbon footprint amongst the public officials, and the parliamentary elections in spring 2019 are called climate elections.

The role of the consumer in controlling their own energy consumption in the future will become greater. Electricity will be produced using wind and solar power which means that on windy and sunny days cheaper electricity will be available. Consequently, there will be a demand for energy storage solutions and energy consumption control systems for customers. Consumers are more interested in smart heating systems and solar energy production.

The interviewed experts noted that as contrast to globalization, projects or solutions that include a sense of community are getting increasingly popular. People like to participate in events and projects that emphasize working together with people from their neighbourhoods. Solutions, such as shared saunas are becoming more popular. However, it is not clear whether people are ready for sharing economy and that they will share their property.

In the field of financial support, the experts pointed out that multiple actors fund projects, but entrepreneurs focus ones that suit their company. Usually, startups need help in financing, finding an investor, expanding their networks and finding clients. From the experts' point of view, startups should collaborate more with each other so they can find projects that they have in common. Also, startups should be presenting their solutions at different events or directly to the larger actors more often.

Germany

Experts

German key business developers saw the potential for the startup industry early and therefore developed a far-reaching support network, which combines different sectors and different objectives. There is a lot of support available and its implementation depends on these objectives. Accelerators and incubators have shown, that in many industries, growth, diffusion of products and technologies can be done and can be constructive when using external support.

There are no particular regulations for smart homes that vary from general regulations in the building and housing sector, for example, the GDPR. The same regulations, guarantees and returns policies apply to smart home products and services.

Funding for smart home solutions is available, either as regular startup support instruments or as smart home specifically. For example, instruments supporting energy efficiency (then it will be supported from KfW or EEG) and regional development funds. Generally, the use of renewable energy sources and techniques is subsidized by the government, as these political targets align with the Paris and Kyoto agreements. The Smart Home Monitor 2017 states that the potential of this market is estimated to be worth 22,2 billion EUR. And 40% of Germans are interested in smart home technologies and solutions, but 23% are not at all interested in them. The main reasons for customers to choose smart home technologies instead of conventional housing solutions are the comfort, security and the fun of it. The reasons for scepticism towards these technologies comes from worries about privacy, incompatibility of devices and the fear of cyber-attacks.

Support organizations like the Allianz für die Region know the term but have not been particularly interested in supporting the development of consumer cleantech initiatives, organizations or startups.

Latvia

Startups and SMEs

The interviewed startups and SMEs agreed that the regulations are similar to the rest of the EU, making it easier for Latvian companies to develop their business abroad. The companies also value the level of competences of the legal representatives, especially in the field of support programmes.

The startups value the ease of doing business in Latvia because it is not harder to do so than in any other EU country and because of the newly established support systems as there is more financial support available now. Also because of the opportunity to participate in different international activities that help them develop their business further and outside Latvia.

It is also possible for startups to get help from universities when they are starting their venture. Academic institutions support startups by providing mentoring, a chance to meet experts in the field and support in creating prototypes.

The government support for startups could be better, but changes are happening.

Experts

It is easy to start a company in Latvia – one can open an LLC for 1 EUR, a bank account can be open only after receiving company's number (unless it is a non-citizen – in this case, it is obligatory to show a list of business activities and clients, but it is not obligatory to present contracts).

In the field of support programmes, no matter in which industry a startup or SME is planning to work, it can find an organization that can help. However, smart home is not the most popular industry for startups. The experts from support institutions mentioned the good partnerships they have with other institutions in, and outside of, Latvia, which helps deliver greater value for new startups.

Norway

Startups and SMEs

Generally, the startups find it easy to start and run a business in Norway, as the support system is well established and funded. There are not many requirements to start a company, and there is a variety of company forms to choose from which can be adapted to the needs of the owner and the business.

One of the interviewed startups mentioned that the high levels of taxation in Norway can sometimes be a problem for startups. It wished to see a sort of subsidiary for startups so that they are not required to pay as high of a tax during the first few years.

The other interviewed startup, mentioned the regulations of electrical grids make the creation of mini-grids impossible. If energy is privately produced through solar panels, these panels have to be connected to the national grid and sold to the grid owner — in Norway, the grid owner is the state. This means that it is impossible to sell any surplus to a neighbour. Private owners cannot choose to whom and at what price the electricity is sold.

The interviewed startups stated that legal advice is essential for new businesses. They highly value administrative advice and support, such as what documents are needed, and which permits are mandatory. One of the startups wished to see a sort of step-by-step instruction for startups on what they need to do and how to do it, especially listing the laws and regulations that every company registered in Norway must abide by. Further, they also wished that they could find all vital information (for running a company) in the same place.

The startups mentioned the importance of a good network, opportunities to test their ideas, financing and offices where they can share and learn from the experiences of others as valuable. Financing is the main issue for startups. While many grants are available for equipment, there are no grants for salaries. The startups would preferer support in the form of opportunities to test prototypes in buildings as well as getting advice on legal issues and relevant expertise, access to the market and reaching investors.

When trying to establish themselves on a new market, the startups mentioned the value of a strong network, new business relationships and legal advice. A supporting partner in a new market would work as a link between the companies and the new relationships they would like to establish.

Experts

None of the interviewees could think of any specific law or regulation that complicates or hinders business, but one of the interviewees mentioned the case of Uber in Norway. UberPop was illegal because the drivers did not have a taxi permit, and that the low fares potentially led to unfair business advantages for Uber within the taxi market.

Discussing the ease of doing business in the context of legal regulations, one intermediary mentioned that most of the startups struggle with tax rules and law, especially at the beginning, which is why legal advice often is offered to startups within incubators.

The biggest barriers to business activity mentioned by the experts included financial support from both business angels and VC, problems in scaling a company and costs of production and salaries. While investor capital is available, it depends on the sector.

One of the experts said that they do not support startups in winning customers, while another gave examples of such support by arranging meetings between corporations and startups or facilitating accelerator programmes. The experts agreed that their organizations provide support for companies in building their own business networks through distributing relevant contacts with business angels, mentors and the industry as well as running events.

As for the biggest challenges in working with supporting startups, the experts mentioned that there is a difficulty in prioritizing between startups and figuring out who needs help the most and when. Oslo's startup ecosystem is relatively immature, but the process of developing the ecosystem is accelerating. For example, it is becoming more common for larger companies to invest in startups, which improves the outlook for getting funding and finding clients.

Finally, another challenge in supporting startups is having a global perspective from day one. Financing is also an issue for many startups. While there are good opportunities to get financing during the early stages of development, it becomes more difficult the closer startups actually get to scale their companies. One reason for this is that investors tend to prioritize property or stock markets something the experts actively work to change.

Poland

Startups and SMEs

There are no specific regulations for the smart homes sector in Poland. Since the market is growing, the companies are interested in legal aspects that could support their growth. The interviewed smartups noted that the information about the following legal aspects is the most useful:

- consumer protection regulations
- sale channels
- product/service certifications, especially for green products and services
- invoicing
- export contracts – conditions
- public procurement

The smartups reported that the tax system is very complicated and that they need more support when deciding on a legal status for the company as well as more support with contracts and employment regulations.

When it comes to financial issues, the startups are mostly interested in R&D financing, seed funding, advice on sales channels as well as product -market fit. Marketing is another area where the startups are looking for support. When it comes to support from abroad, the startups are mainly interested in business development opportunities, including access to mentors experienced in global sales.

What helps the startups the most are acceleration programmes, especially if they offer business opportunities, such as access to decision-makers in big companies. The startups said they also need help in the following areas:

- virtual online consulting
- networking

- setting up meetings
- opportunity to go abroad for a given period of time
- matchmaking with international partners and customers.

Experts[52]

When it comes to basic legal regulations for starting a business in Poland, "it was stated in the World Bank report that Poland was recognized as one of the most startup-friendly ecosystems in the world, ranking higher than the established hubs such as Australia and the UK. This gives Poland a great opportunity to become the centre of the European startup ecosystem, attracting ambitious entrepreneurs to join the vibrant community. it should be noted that renewables (Green Industry) are a dynamically developing branch of industry in Poland"[53].

The legal experts pointed out that there are no specific regulations neither for the consumer cleantech nor for smart home sector. This means there is a lot of room for regulatory changes in the consumer cleantech sector.

Over the last few years, the startup ecosystem in Poland saw a lot of progress. Nevertheless, there are still too many complicated legal and tax procedures that entrepreneurs have to deal with. Therefore, a move in the right direction would be to simplify the existing procedures. In our opinion, the clarity and transparency of legal instruments and requirements imposed by state authorities is key to success for a smartup. Many institutions provide advisory services to new investors from various industries. The state should offer more support in developing such institutions that will help entrepreneurs find their place in the cleantech industry. Furthermore, in order to enter the Polish market, an understanding of the Polish business culture is essential. And that's [sic] where the institutions supporting startups can also help. We are convinced that a more business- and innovation-friendly approach of state authorities and business support institutions will allow entrepreneurs to spread their wings[54].

In the case of business support organizations, the main focus is on:

1. infrastructural support (such as labs and offices)
2. financial support (public, EU funds)
3. other support: marketing, communication, events, reports, startup database, conferences, business breakfasts, contacts with media, mentors' network

Business support institutions find the following as barriers in effectively supporting business (especially startups):

- lack of financial instruments (except for EU funds, which are not easy to get)
- business support institutions lack business financial support tools
- municipalities, business support institutions do not know enough about how to support startups, they do not know their needs
- business support institutions do not have any decision-making power – hence it is difficult to assess which tools of support are or are not beneficial
- financial budgets are not big enough to effectively support startups

In terms of the support process, what business support institutions usually offer are as follows:

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[52] Interviewees – representatives of the following organizations: Wroclaw Agglomeration Development Agency, Wroclaw Technology Park, Lower Silesia Academic Entrepreneurship Incubator, Ełk Science and Technology Park, Olesiński & Wspólnicy, RM Legal, SDZ Legal Schindhelm and PGE Nowa Energia.
[53] SDZ Legal Schindhelm representative.
[54] Ibid.

- preincubation level – matchmaking with recommendations, networking, communication
- incubation level – matching startups with their potential business partners/clients or one-stop shop (answering startup questions online)
- acceleration level – tech conferences, supporting big companies that run their acceleration programmes, online services with legal advice or job marketplace, aggregating information (such as startup database)

Tighter cooperation between the actors in the startup ecosystem would provide a better flow of information as well as lead to better results. Universities, business, VCs, NGOs, society, accelerators, experts, mentors, etc. should work together to achieve their common goal, that is an expansion of an innovative ecosystem, and this also includes the consumer cleantech sector. Such processes need time, especially if they are about new technological trends and new markets. It is equally important to educate all entities in the ecosystem, engage international organizations, exchange ideas and experiences.

From a business development standpoint, increasing the demand for intelligent installations mostly depends on:

- growing needs to save energy
- dissemination of home devices that use Wi-Fi
- growing need to ensure security
- ageing of society[55]

Smart homes technologies are still developing. Companies that offer intelligent solutions to focus on educating their customers. There are still many barriers that need to be overcome, such as:

- lack of understanding of smart homes technologies
- still relatively high costs of such solutions
- technological issues – many devices are still not compatible with one another[56]

The smart homes market is still at an early stage, which creates many business opportunities that could become a significant part of the market in the future. This could result in gaining long-term and loyal customers[57].

Russia

Smartups and SMEs

The most useful legal information for startups and SMEs is on certification and permits. Other important areas that startups and SMEs need to be supported in are taxation, governmental procurement, legal registration of the company and obtaining permissions from supervisory authorities.

Lack of financial support is the biggest barrier for business activity in Russia, as well as weak institutional support. As are complex legislative rules, the lack of previous experience in new technology introduction and poor governance.

The startups indicated that business incubators offer the most effective support. Other supportive institutions are science and technology parks and free economic zones. The most desired elements of support are networking and financial support (such as subsidies for R&D, tax benefits, patenting and certification).

[55] PGE Nowa Energia representative.
[56] Ibid.
[57] Ibid.

Subsidies from the Ministry of Industry and Trade of Russia reimburse expenses for specialized software, and subsidies from the Ministry of Economy Development of Russia for SMEs are distributed between members of territorial and innovative clusters.

The startups agreed that the most important tools supporting the global development of startups are establishing contacts and interacting with potential partners. Equally important is looking for investors and expanding networks. All startups and SMEs noticed that potential customers and interested investors motivate them to look for support from business institutions outside of Russia.

Experts

The draft strategy, titled Environmental Security Strategy of the Russian Federation until 2025, sets out the main objectives of the state which ensure a healthy environment and sustainable economic development. The strategy nudges the development of the cleantech sector.

The experts noted that legal regulations, that provide the organizational framework for clusters, have to change. Currently, three out of more than 100 clusters specializes in environmental protection and waste recycling. Only one out of the three cleantech clusters in Russia, St. Petersburg Cleantech Cluster, focuses on the urban environment.

The experts agree with the startups, that establishing contacts is necessary in order to help startups in their global development and interacting with potential partners/clients.

The main issue mentioned by the experts is insufficient financing for startups and SMEs. The experts underlined the importance of their work for startups and SMEs and the significance of development and diffusion of knowledge. When it comes to startup support, the experts do a lot of consulting (individual meetings, joint meetings with mentors and external experts, presentations) and assist in the implementation of new technologies.

The experts value peer-to-peer learning and see it as a way to share experiences and knowledge within companies.

Most of the experts and their organizations noted the importance of contributing to the development of social capital (trust and understanding between actors).

Sweden

Startups and SMEs

The smartups mentioned the following legal regulations where they would like to receive more support:

- Certifications and regulations
- Intellectual property (IP)
- Advice on General Data Protection Regulation (GDPR)
- Contracts with shareholders and suppliers

Furthermore, advice and support with various legal questions are crucial when running a company. Legal regulations are vague and in some areas are not developed because products (business field/idea) are relatively new. Moreover, the uncertainty regarding what may be regulated and/or subsidized makes investments difficult and too risky.

In terms of the largest barriers to business, these vary between companies. The lack of regulation means investments in developing areas/products/services are too risky. Another barrier mentioned is high costs, one company pointed out that high rents are sometimes prohibitive. Finally, innovations delivered by companies may not have the credibility.

Attracting VC and external expertise was noted as necessary for development. Support institutions also play a significant role by providing access to important contacts including scientists, consultants and suppliers as well as support through governmental research institutes and financiers.

For the companies that participate in acceleration programmes, the most important benefits included legal advice and financing. And an opportunity to request relevant talks delivered by experts.

When asked how an accelerator for smartups should be designed, suggestions included that the programme should be tailor-made for businesses as well as for the market in question. It was further suggested that learning could be done via talks delivered by relevant speakers or providing opportunities to connect with people for aboard or experienced entrepreneurs so they could be mentors. The insights gained from such programmes include, for example, learning how to scale a company, both from an organizational and a technical point of view. The programme could also offer financial support and pave way for the company to gain visibility and reach a wider and/or new audience.

The support systems which the startups saw as most valuable were provided by incubators, government-owned research institutes and agencies, and large, established companies. The startups describe that the most effective instruments available to them include legal advice, general business coaching, technical expertise and access to networks. It was mentioned that there is potential for an exchange with neighbouring companies, especially companies that offer similar services but are in a different phase of development. Two companies also stressed the importance of financial support, but all three startups described funding as an important aspect. Funding can be attained both through institutions that provide loans or grants, as well as via institutions that guide startups in the process of obtaining financial support from other organizations.

The support that the startups suggested may be the most valuable to their global development was access to contacts that know a lot about the market they would like to enter. In particular, areas such as market fit, appropriate resellers, marketing, local producers or promotion partners and information about how to get financing in the new market.

Events with representatives from different countries are suggested as a means to get insight into a new market. The startups said that they need help in getting grants, finding investors, expanding their network and finding clients.

Experts

Applications for environmental permits can be hard to fill out correctly, yet companies do not receive any feedback on their applications if they contain errors. This can mean that companies continue to make the same mistakes, which can prolong the process of gaining permits.

Several industries in Sweden recruit internationally due to a shortage of skills in a particular area or areas. The process of obtaining working permits has become a bottleneck, which takes, on average, five months to complete. This makes hiring foreigners difficult which in turn stems business growth. Taxation is another problem. New and streamlined regulations regarding stock options have been introduced, but this has not led to the desired outcome.

Another important aspect that was mentioned, is the cost of climate impact and that it is rarely absorbed by companies and this complicates the development of businesses within the cleantech market. By making legal changes that would make it necessary for companies to internalize the cost of external factors, such as pollution or spills, the cost of running a non-sustainable business would increase. This would offer a different business climate for greentech startups. It is further mentioned that there are political risks that pose an amount of uncertainty within the cleantech market. This is because markets are driven by regulation and that it is difficult to foresee how the market will develop. Administrative aspects are also problematic, as are the fast changes in, and the complexity of, law. One suggestion is that there could be some kind of “fast lane” for green innovations to obtain permits. This could speed up the process of entering the market and offer an incentive to develop more sustainable innovations.

The experts indicated that finding necessary and needed competencies in people is one of the most challenging areas for business in Sweden. Finding key employees may be easier if the company is connected to well-known universities, for instance. Other barriers include getting access to capital, both VC and loans. The support for companies in reaching customers varies. Providing services for business development is seen as a means of supporting companies in this respect, while still stating that it is a company's responsibility to reach its new customers.

The challenges that the experts viewed as the most common for the startups they have met include access to talent so that they can building of a good team. Financing is also something that experts noted to be a common problem. When it comes to companies that are-centric, the need for capital tends to be a lot lower and that it is easier to get it.

Challenges in working with and for consumers can happen when companies have not scanned the market. The experts considered market scanning to be incredibly important, and it is in this area that the expert advice is needed.

When it comes to internationalization, reaching foreign markets was noted as one of the challenges. Difficulties related to the process of internationalization are often underestimated, and more often than not, physical presence on the new market is important. This is a process that can take more time and be costly for B2C companies. Further difficulties include a general lack of knowledge. Establishing contact and exchange with large companies is important, and startups do not always realize the importance of having a big network that can help in reaching customers.

2.4 Digitalization

Estonia

Estonia has a niche capability in the design and engineering of hardware and software solutions for intelligent transportation, urban planning, tourism and smart homes. Advanced digital infrastructure, skills and consumer adoption provide the ideal R&D testbed[58].

The smart-home ecosystem is continuing its rapid expansion, but market growth rates are directly linked to the speed of 5G implementation[59].

Smart homes solutions are developing rapidly to make people's life more comfortable. Challenges related to the transfer from manual control to automatic and centralized control of devices are very interesting for startups as well as large companies. What is important to note that buildings are not smart because of the devices installed in them but because the installed devices collect and use data, including data about users and residents of these buildings. As a result, the application of smart technologies may entail risks in the area of data privacy and cybersecurity.

When processing personal data, the EU General Data Protection Regulation and the Estonian data protection regulations apply. Following these regulations, a property owner must remember that people have rights, including the right to access the data collected about them, the right to have the data rectified and to have their personal data erased[60]. Management of data is an important issue that has to be covered by innovators.

Finland

According to the EC, Finland is the third most advanced European country in the digitalization of business[61]. Digitalization changes consumers and this change is strongly interlinked with activities at home, especially when during these activities people use devices connected to the Internet. According to the 2013 estimate by the OECD[62], a family with two teenagers will own, on average, 50 Internet-connected devices by 2022. According to Gartner, a household will have over 500 smart devices in 2022[63].

Digitalization is a change that impacts all sectors of business and public services in Finland. The ongoing change has been compared to the earlier industrial revolution that not only thoroughly changed the production methods but also the business, society and households[64]. Also, digitalization has completely changed how businesses connect with customers. These days, customers expect a closer digital relationship than ever before. Consequently, with constant and personalized interactions, companies can build a loyal and profitable customer base[65]. This is especially important in the case of smart homes solutions, where personal data is so important and vulnerable.

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[58] https://investinestonia.com/business-opportunities/smart-cities
[59] https://www.statista.com/outlook/279/134/smart-home/estonia#market-users
[60] https://www.njordlaw.com/can-a-smart-house-be-a-backdoor-to-your-personal-data/
[61] https://info.microsoft.com/rs/157-GQE-382/images/How%20Finland%20is%20embracing%20digital%20transformation2.pdf
[62]http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP(2015)3/FINAL&docLanguage=En
[63] https://www.gartner.com/technology/research/
[64] https://www.kkv.fi/en/consumer-education/smart-home/
[65] https://info.microsoft.com/rs/157-GQE-382/images/How%20Finland%20is%20embracing%20digital%20transformation2.pdf

Germany

Germany is a world leader in technology, but its digitalization process is still developing[66]. Nevertheless, the government intends to shape the digital revolution and prepare the country for the future. The government aims to further improve the quality of life of everybody in Germany, to develop economic and environmental potential and to ensure social cohesion. The Digital Strategy embraces five fields of action: digital skills, infrastructure and equipment, innovation and digital transformation, society in digital change and modern state[67].

There are around 500 000 smart homes in Germany and growing[68]. This particular market is becoming more appealing because of the increasing role of the IoT as well as hardware that is getting smaller and cheaper. Major barriers in this field include entering the market and figuring out what is most important for users because this emphasizes how users experience technology, rather than emphasizing technology itself[69].

Latvia

Latvia is a leader in connectivity but its human capital and integration of digital technology components rank below other Baltic countries[70]. Latvia needs to encourage progress in the integration of digital technology[71]. But the country is starting from a relatively good position with respect to its digital infrastructure and this includes the smart homes sector[72].

"While Latvia has a higher than average share of individuals and firms using the internet to interact with public authorities, reinforcing trust in digital activities remains an essential factor to spur ongoing adoption of new services[73]. Investment in public and private research and innovation is needed to drive digital transformation further and develop and diffuse new technologies, products, applications, business models and organizational structures"[74].

Poland

The working group of the IoT was established with an objective to identify actions necessary to enable development and common use of IoT-based solutions so that they have a real impact on Poland's economic growth – the first stage was initiated in 2018 by the then Secretary of State at the Ministry of Digital Affairs[75]. The activities were divided into three subgroups 1) legislation, 2) standards and certification, 3) projects and finance. Since January 2020, the IoT group has been focusing on developing projects, which would support the common use of IoT in the following areas:

- Smart Cities and Smart Homes/Buildings
- Smart Agriculture
- IoT in the Healthcare System
- Smart Transport
- Standardization
- Legislation[76]

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[66] https://www.thelocal.de/20190902/four-ways-digitalization-is-changing-germany-ottonova-tlccu
[67] https://www.bundesregierung.de/breg-en/news/the-digital-strategy-of-the-german-government-1550216
[68] https://www.dw.com/en/smart-homes/a-18746271
[69] https://blog.bosch-si.com/bosch-iot-suite/experience-smart-homes-in-new-ways/
[70] J. Cesnauske, Digital Economy and Society: Baltic States in the EU Context, Economics and Culture 16(1), 2019.
[71] Ibid.
[72] http://www.oecd.org/policy-briefs/Latvia-digitalisation.pdf
[73] http://www.oecd.org/policy-briefs/Latvia-digitalisation.pdf
[74] Ibid.
[75] https://www.gov.pl/web/digitalization/working-group-for-the-internet-of-things-iot
[76] Ibid.

Poland has progressed steadily since 2014, in line with the overall EU Digital Economy and Social Index (2018) evolution results. The main strengths include a high number of STEM graduates (above the EU average) and a notable improvement in broadband coverage. However, some of the most pressing points are the shortage of basic digital skills in the population and a low number of experienced ICT specialists[77]. Compared to the results from DESI 2017, Poland's ranking has improved in the areas of Connectivity and Human Capital and Use of Internet and Integration of Digital Technology. Poland is currently implementing the Operational Programme Digital Poland for 2014-2020[78].

In 2019, one-third of people in Poland who were building a house or renovating an apartment decided to install smart devices. Poles most often use smart TVs and watches, but also security solutions such as alarms, sensors and monitoring cameras. In the home smart devices market, intelligent door locks are becoming more popular[79]. One of the main reasons for the growing popularity of smart home solutions is because they are convenient and secure.

Russia

Implementation of digital technologies in the housing and utilities infrastructure stems the programme “Digital Economy of the Russian Federation”[80]. The driver for the development of housing and utility infrastructure digitalization is an implementation of intelligent devices for measuring all types of resources and energy consumption in houses which will be gradually standardized in an intelligent system of resources consumption with the use of SIM-cards[81].

Housing and utility infrastructure (HUI) are one of Russia’s economy largest sectors and it ensures the economic and social development of the country. The domestic housing and utility complex amount to about 6% of the GDP[82]. The process of housing and utility infrastructure digitalization began with the creation and implementation of the state information system (GIS GKH) in 2016 – the process was easier to implement because information from all housing and utilities enterprises within the Russian Federation is stored. The activity of the housing and utility enterprises is regulated by the Federal Law No. 209-FZ dated July 21, 2014 "On the state information system of housing and utility infrastructure".

Sweden

The economy has the highest share of value-added produced by the ICT sector amongst the OECD countries and is amongst the top ten exporters of ICT services worldwide[83].

The smart home niche is not thriving despite the continuous development in technology[84]. However, nowadays, according to the Digital Market Outlook, the smart home penetration rate is expected to be 53% in 2025[85]. With the rapid development of IT, the field of home automation has been expanding. The interest in, and demand for, smart home technologies have increased significantly[86]. Swedes continue to connect their homes and now have 16,9 connected devices per household – this figure has

[77] https://ec.europa.eu/information_society/newsroom/image/document/2019-32/country_report_-_poland_-_final_2019_0D31398C-9ADF-2298-6271E3F8A62388F2_61217.pdf
[78] Ibid.
[79] https://wbj.pl/smartphones-increasingly-support-smart-homes/post/127460
[80] I. Drozdova, A. Petrov, World practice and Russian experience of housing and utilities sector digitization, SHS Web of Conferences 44, 00031 (2018).
[81] Ibid.
[82] Ibid.
[83] https://www.oecd-ilibrary.org/docserver/9789264302259-en.pdf?expires=1598483655&id=id&accname=guest&checksum=292BE09DC4202B1B7C50A600D550E91D
[84] https://www.diva-portal.org/smash/get/diva2:1127577/FULLTEXT01.pdf
[85] https://www.statista.com/forecasts/887720/smart-home-penetration-rate-per-segment-in-sweden
[86] http://muep.mau.se/handle/2043/27954

grown by 33% compared to 2017. Smartphones and tablets are at the top of the list, but the number of connected speakers and security solutions grew significantly in 2018[87].

[87] https://www.teliacompany.com/en/news/news-articles/2019/connected-devices-2018/

3. Conclusion

The smart home sector is at different stages of development in each of the discussed countries – this stems from the fact that consumers in each country have different needs, for example, consumers in some countries are driven by cost (making products/services cheaper). Developers often decide not to invest more money into smart homes devices, as this generates higher costs, which might not lead the desired (or planned) ROI as quickly as expected – many customers still treat such solutions as extravagant, even if this means more comfortable, safe or healthier everyday living in the future. It is also the result of diverse levels of environmental awareness.

Another noticeable aspect is that there are no clear legal regulations in the consumer cleantech sector, including smart homes, and hence there is no large financial stream to support smart home solutions. This might be because this is a growing sector. More actors in this emerging ecosystem are looking for opportunities to strengthen it, especially innovative startups that are developing dynamically and often set new trends even before customers are ready for these new ideas (businesses, governments and consumers). It seems that the biggest opportunity lies in the consumers' education about environment protection, as smart solutions also provide water or energy saving. Well-educated consumers might generate the biggest and most sustainable demand for such solutions. Then the money will follow.