

Smart Connectivity Vision paper



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REPUBLIC OF ESTONIA MINISTRY OF ECONOMIC AFFAIRS AND COMMUNICATIONS



Vision for smart connectivity

Let's envision, in the foreseeable future, that the previously little interconnected Three Seas (3S) region has turned the tables through joint and coordinated efforts on smart connectivity. Smart connectivity entails investments into linking our energy and transport infrastructures physically-developing, adopting and linking digital platforms and services that allow for the best management the use of linked infrastructures.

In this way, we further develop our vital infrastructures and services that underpin much of economic development – integrating our economies more widely by allowing for companies to develop and run business models that span from Tallinn to Varna or Dubrovnik. **The 3S region is a global hotspot for smart mobility and energy innovation, developing and selling solutions around the globe.** Smart connectivity development has also boosted the potential of the digital economy more widely and has allowed us to more effectively combat the biggest challenges tied to the decarbonisation and greening of our growth.

The 3S region is one integrated energy area, while also a vital part of the European energy union. Our energy markets are linked, helping each of the countries to manage the energy demand and supply more efficiently and ensuring energy security without reliance on outside players. Interoperable smart grids intersect the 3S region, and innovative renewable energy technologies spread through the region's countries, too. Whether in a village in Poland or city in Austria, we have active prosumers – where there is wind, water or sunshine, there are energy producers feeding the entire region with necessary and clean energy. Real-time data flows, adoption of smart monitoring and interlinked grids also allow for smarter energy management. This has raised the 3S region's countries to the top in energy use efficiency when compared to the EU.

In a similar way, smart transportation corridors cover the whole 3S region. Autonomous and sustainably powered vehicles can cross all the way from North to South, from East to West and back as necessary and interoperable smart transportation networks are there, aided by intelligent transportation systems. The ability to integrate those networks and systems has also allowed for smarter planning and management of the movements of both goods and people. This brings new mobility services and unlocks multi-modality, which offers more connectivity and saves time and money in return. It is especially visible in freight transport, where the entire supply chain can be automated. Goods can move from Industry 4.0 factory via autonomous on-demand vehicles on smart roads or railways to smart logistics centres without labour-intensive human work and with no (paper) bureaucracy creating friction in the supply chain. Real-time data flows, digital documentation, smart controls and supervision, optimised infrastructure and traffic management, etc. make this possible. As a related outcome, our transportation has finally become environmental-friendly and low in energy use.

Smart energy and smart mobility advances and **integration has been made possible by putting in place the necessary digital enablers** – ability to share and re-use bits and bytes makes our region move ahead. These enablers were first introduced to allow for smart infrastructure and new business models in mobility and energy primarily, but now support digital innovation and functioning of the Digital Single Market in 3S region more widely.

5G and soon 6G networks will enable the initial flow of data, with roaming making it smooth throughout the whole 3S region. Data exchange, pooling and re-use platforms and standards are widely adopted to allow for interoperability and technical data sharing, in mobility and energy sectors as well as beyond. Data markets function to incentivise the re-use of data. In all the 3S countries, people have secure digital identities and digital signatures available – and these are interoperably usable throughout the region. The functioning of these digital enablers as well as smart energy and mobility networks and solutions is underpinned by region's capability and joint efforts in cybersecurity, which ensures the necessary trust environment.

The future we choose is our path forward in creating both niches economic and political strengths. Our determination to be internationally recognised leaders in development is underpinned by our engaged communities and our empowered citizens. Each new joint initiative fosters our living vision and further defines us as a generation that brings greater unity to the region.

As for the future, to foresee it is not sufficient. Enabling it grounds the leadership of tomorrow. Each time an individual contemplates the 3S is an opportunity to see the future through a new lens. Moving forward needs strong institutional guidance through challenging times. The Three Seas Initiative Coordinating Secretariat would play a pivotal role in carrying out our mission of joint initiatives, cooperation and mutual development. Our greater support could speed its further vision-led and change-oriented work.

The Three Seas Initiative can make it all happen. It has the potential to be both the coordination as well as the investment platform and catalyser for a smart connectivity burst in the region. It takes digitally-minded political will to set the directions and launch joint initiatives, making use of and within the wider framework of EU policies, funding mechanisms and collaboration initiatives.



Smart enablers

Everybody knows the future is digital. At the same time, people's understandings of the digital future vary from end to end. Whoever manages to spread the interoperability standards necessary for digital services across domains and regions will have an enormous competitive advantage. Whether in the field of digital identity, e-signatures, data exchange and interoperability, e-invoicing, open data pools or standardised application layers for the private sector for data re-use and services provision, the possibilities are endless. The core path is the same: to make smartly planned investments along connectivity corridors for data gathering, to deploy interoperability enablers such as standards and singular identity for digital services and to make digital infrastructure open and interconnected for developing ecosystems. Be it a smart grid or smart mobility, from sea to space, digital solutions are being introduced the world over. Digital solutions deployment and timely uptake can be a competitive edge which could differentiate the 3S region Globally as well as making it a pioneer in respective fields.

Generating more data and changing the way data is used is critical to solving social, economic and environmental challenges, which, in turn, leads to safer, more stable and more resilient communities. It will contribute, for example, to better policies to meet the goals of the European Green Deal. The EU's digital strategy 'Shaping Europe's digital future' proposes green transformation measures for the ICT sector. Many sectors can benefit from the digital layer to enhance their products and processes.

A federated cloud and common data space as a path towards economic growth

The European Commission has taken many steps to foster digital challenges with regulatory ramification and standardisation and by supporting collaborative initiatives. The European Commission put forward the European data strategy and envisioned the future of common data spaces approach for the union as follows: "The aim is to create a single European data space – a genuine single market for data, open to data from across the world – where personal as well as non-personal data, including sensitive business data, are secure and businesses also have easy access to an almost infinite amount of high-quality industrial data, boosting growth and creating value, while minimising the human carbon and environmental footprint.⁴¹

The sectors of energy, industry and transport are those that will have the biggest impact on the entire ecosystem and citizens. This has been recognised by the European Commission, which is working on a legislative framework for the governance of common European data spaces by the end of 2020. This framework should establish European data spaces for industry, green deal, mobility, finance, energy, public administration and for skills. The European Commission will invest in a High Impact Project on European data spaces and federated cloud infrastructures to facilitate collective investment up to 6 billion over the period 2021-2027. The first phase of implementation is foreseen for 2022, as set out in the European Data Strategy. In particular, the European Commission intends to finance the development of common interoperable data spaces across the EU in strategic sectors.²

The project will finance infrastructures, frameworks for data sharing, architectures and governance processes for efficient ecosystems for data sharing and artificial intelligence. It will be based on the European federation of energy-efficient and trusted edge and cloud infrastructures (Infrastructure-as-a-Service, Platform-as-a-Service and Software-as-a-Service). This project will involve and benefit the European ecosystem of data-intensive companies and will support European companies and the public sector in their digital transformation.³



Along with data spaces, the European Commission will promote the setting up of a cloud services marketplace for EU private and public sector users by Q4 2022. The marketplace would allow potential users (especially the public sector and SMEs) to choose cloud computing, software and application services that meet multiple criteria in areas such as data protection, security, data portability, energy efficiency and business practices. It opens up an investment opportunity to build data centers across Europe for federated cloud services while ensuring that there are reasonably limited regulatory restrictions for institutional clients.

As we can see from the above examples, the European Union is an exceptional platform to have a shared understanding and alignment of rules, standards and solutions and is supports the 3S connectivity goals. There is a multitude of jointly agreed directives and regulations on data and online services, along with digital enablers such as for Free Flow of Data⁴ or digital signatures. Together with the European Commission, member states have taken big steps in terms of cross-European interoperability. However, the actual **take-up of these solutions and rules is sometimes lagging behind**. Now it is time to utilise the agreements and solutions for advancing our digital society ourselves. Private sector needs and ideas should be expressed in the process of standardisation to facilitate possible quick uptake of the solutions. The Three Seas Initiative has the potential to become a digital investment and discussion platform where a likeminded group of countries is able to advance with the deployment of cross-border digital services enablers. The Three Seas Initiative has the potential to become an innovation deployment spearhead for smart corridors, if projects are aligned with European Commission innovation pilots and coordinated among ourselves.

Spearheading innovation through coordinated uptake

3S countries could benefit directly by spearheading the interoperability standards necessary for digital services and making them mandatory. Whether in the field of digital identity and e-signature, B2B e-invoicing, open data pools, or standardised application layers for the private sector for data re-use and services provision, the possibilities are endless. The core path is the same: **to make smartly planned investments along the connectivity corridors for data gathering** (IoT, corridor as a service etc.), **to speed up the uptake of interoperability enablers such as standards and singular identity for digital services** and **to make the digital infrastructure open for developing ecosystems**.

On 19 March, 2019, at The Transatlantic Quest for Cyber Trust - Cybersec Washington Leaders' Foresight, the key takeaway was that the **3S countries should develop** a strategic agreement to act and think as a like-minded region about which technologies to embrace and how. There should be joint or unified plans to develop or enhance investment in the key areas. It is fundamental to enhance uninterrupted connectivity between the communication systems in the region along the North-South axis. The digital infrastructure can be built with a focus not only on commercial value but also on strategic value. Fibre optics and telecommunication antennas can be built in conjunction with highway infrastructure, which is also relatively easy in terms of regulations. At the same time, smaller-scale cross-border infrastructure projects that will ease existing communication bottlenecks or create new connections are vital as they contribute to the overall big-picture connectivity. It is important to invest in these shortterm local solutions as they will provide much-needed benefits and stability.5 The Three Seas Initiative has identified ten digital domain projects which range from the national to the multilateral. The remaining 38 projects in the transportation and energy domain also have the potential for digital layers or can be considered as a potentially high-value source of data if IoT or other digital enablers are deployed in a coordinated way.

In the List of Priority Projects, there are projects involving mobility and network and broadband initiatives. There are projects for hydrographic base data, trade marketplace, sustainable energy roadmap, smart city collaboration forum and cross border public safety collaboration. Additionally, there is the 3 Seas Digital Highway project as one of the most ambitious infrastructure projects proposed in terms of digital collaboration.

The ambitious Three Seas Initiative can do more. The quality of the digital projects runs from the cross border aspect, which would efficiently complement the services layer.

The business case of each digitalisation project is of utmost importance for the success of the region. There are endless opportunities in terms of server parks development, cybersecurity applications, interoperable digital services for logistics or even 5G or IoT infrastructure solutions. The Three Seas Initiative can establish an accelerator type of framework for digitalisation projects and renew the list of digital projects by collecting new project ideas that would be scalable and services-oriented.

Better coordination brings timely results

It is evident that for the full realisation of the commercial potential of the 3S projects, it is necessary to collaborate in a coordinated manner to pinpoint the potential and find funding for the expansion of the projects. Many of the digital projects listed for Three Seas Initiative have the potential to enhance the transport corridor or energy grid projects with a digital services layer or data utilisation optimisation. Support for the collaboration between 3S projects needs coordination on a semantic, procedural, financial and technological level. Political will and like-mindedness are needed to support the initiatives, and the 3S is the only and most diverse region in Europe to have a functional platform for that.

For example, through smart planning, it would be possible to adapt infrastructure projects to environmental needs and possibilities for better alignment of resources.



By applying Building Information Modelling (BIM) open standards throughout the building lifecycle (including planning), it is forecasted⁶ that the broader adoption of BIM will unlock 15-25% of savings to the global infrastructure market by 2025. The key enabler for Smart planning is making data-driven decisions based on a holistic set of machine-readable data about our environment. The prerequisite for this is the cross-border adoption of a common digital language describing the built environment. By classifying the location, function and properties of objects using a common system we can connect different data sets and bring to light dependencies and relations that are crucial for making sustainable planning decisions. Governments and public sector organisations should drive the industry towards an untapped digital market which, in exchange, offers better public

services and better value for public money. Nonetheless, policymakers cannot do this on their own: collaborating with business at EU and national level is essential in order to implement this digital transition, taking due account of market trends, employment, skills development, small and medium-sized businesses and improvements to current practices as proposed by the EU BIM Task Group.

Project example: Digital Rail Baltica⁷

To manage Rail Baltica as a single asset, RB Rail AS has been developing a detailed BIM strategy for smart planning that will be used during the design, construction and operation of the line. With the design phase well underway and with works ongoing on 411 km of the mainline, the BIM strategy has already been applied, and the designer has already submitted the first value engineering solutions using RB Rail AS proprietary BIM standards. The strategy defines the rules and principles that all parties involved in the project must follow. These rules ensure that all information delivered during the design and construction stages of the project is created and organised using the same principles, to ensure interoperability between deliverable from the different disciplines, and even between deliverables from different design companies. One of the main focuses of this strategy is to ensure smooth information transfer for future asset management so that all the valuable data collected about the assets during the design and construction stages remain usable throughout the entire lifecycle of the infrastructure. In other words, information about the real, physical, built assets is collected, stored and maintained in a database and can be used for maintenance of the railway infrastructure throughout its full operating period.

The implementation of standards and shared compatible formats and protocols for the collection and processing of data from different sources in a coherent and interoperable manner across sectors and vertical markets should be encouraged through a rolling ICT standardisation plan and (with regard to public services) strengthening the European Interoperability Framework.⁸

The development of the digital pillar within the Three Seas Initiative should be rapidly enhanced alongside energy and transport, and cyber-security should be included in all three pillars.⁹ The cyber aspect of the digitalisation should be seen as an enabler rather than the showstopper. As seen in the National Cyber Security Index (NCSI),¹⁰ the 3S countries are well-positioned among the 152 countries in the index. This represents an untapped potential to attract Industry 4.0 in a global context with readily available production facilities and marketplaces ready for fully digitalised processes.

DISCUSSION POINTS

- How to better align with and use the EU funding available for the 3S region's digital services in the context of infrastructure digitalisation projects?
- How to generate better collaboration between 3S countries' individual projects for digital collaboration and interoperability?
- How to stimulate 5G network development along the connectivity corridors?
- How to jointly bring cybersecurity dimension to smart mobility and smart energy (joint) efforts at 3S level? What joint capabilities or efforts would be useful or necessary?
- How to use smart planning to design the connectivity corridors' projects in a more efficient way for the environment and society?

FACTS & FIGURES

- According to the Digital Economy and Society 2020 Index, the majority of 3S countries are below average compared to the EU in terms of digital readiness and development
- The European Commission CEF building blocks offer basic capabilities that can be used in any European project to facilitate the delivery of digital public services across borders (ex. e-Signature, e-ID, e-Invoicing, e-Delivery, for data exchange)
- According to eIDAS Trusted Lists and the EU List of eIDAS Trusted Lists service providers, there are digital signature service providers in all 3S countries¹¹
- Based on the Estonian example, adopting digital identity and digital signature, it is possible to save up to 2% of GDP annually
- Reports forecast that the wider adoption of Building Information Modelling (Smart Planning) will unlock 15-25% of savings to the global infrastructure market by 2025. (BCG, Digital in Engineering and Construction, 2016; McKinsey, Construction Productivity, 2017)
- 3S countries are among World TOP50 according National Cyber Security Index

HIGHLIGHTS

- Digital solutions deployment can provide a competitive edge which can differentiate the Three Seas region from the rest of the world.
- The Three Seas Initiative has the potential to become a digital investment platform and catalyser, bringing together likeminded groups in the context of digital services enablers' deployment in listed connectivity corridors projects. Three Seas Initiative can become an innovation deployment spearhead for smart corridors if projects are aligned with European Commission innovation pilots and the interoperability solutions for data and digital services are deployed.
- EU data strategy opens up an investment opportunity to build data centres across Europe for federated cloud services while ensuring that there are reasonably limited regulatory restrictions for institutional clients.
- 3S countries should develop a strategic agreement to act and think as a like-minded region about what technologies to embrace and how.
- 38 existing and new projects in the transportation and energy domain have the potential for digital layers or can be considered as a potentially highly valuable source of data if IoT or other digital enablers are deployed in a coordinated way.
- The European Commission has taken many steps to tackle digital challenges with regulatory ramification and standardisation and by supporting collaborative initiatives that could be utilised now.
- In addition to personal data spaces, the European Commission has promised to put forward a legislative framework for the governance of common European data spaces.
- It is evident that for the full realisation of the potential of the 3S projects, it is necessary to collaborate in a coordinated manner to pinpoint the potential and find funding for the expansion of projects.
- Through smart planning, it would be possible for infrastructure projects to better serve environmental needs and host possibilities for the better alignment of resources.
- The 3S initiative can promote the adoption of a common classification system for the built environment that will enable holistic and sustainable planning decisions.

Smart Mobility

The fragmentation of the logistics corridors in the 3S region remains a challenge, holding entire industries back and impeding the efficiency of the EU Single Market. While the EU is to intervene on regulatory de-fragmentation, Three Seas Initiative can encourage de-fragmentation of the IT environment of transport corridors. Digital interoperability and multi-modality come as a mighty forward-looking solution for fighting disintegration. The adaptation of infrastructure to new mobility patterns and the deployment of infrastructure for clean, alternative fuels poses an additional challenge that requires new investments and a different approach to the design of networks and business models. Digital technologies have a key role to play in addressing these challenges to provide smart planning and monitoring tools.

The main challenges for the EU transport sector include establishing a functioning Single European Transport Area linking European regions with modern, multi-modal and stable networks of transport infrastructure, and moving towards low-emission mobility, which also implies reducing other negative transport externalities.¹²

In the eastern parts of the EU, improving the quality and efficiency of the transport infrastructure is a challenge, and timely investments could help boost the competitiveness of the region as a whole. There is a need to renovate and modernise railway networks in order to create connections between EU countries, remove missing links between key European roads and remove bottlenecks. Interconnecting terminal transport modes is crucial for the Single Market and for linking Europe with foreign markets and trade partners. The smooth operation of the European network includes the integration and interconnection of all transport modes.



The adaptation of infrastructure to new mobility patterns and the deployment of infrastructure for clean, alternative fuels, poses an additional challenge that requires new investments and a different approach to the design of networks and business models

Smart mobility and logistics integration made possible by digital enablers

Digital technologies have a key role to play in addressing these challenges. Technological innovations and related emerging business models (e.g. ridesharing) have the potential to make transport easier, more efficient and more sustainable. Digital technologies also help to reduce problems such as slow traffic, red-tape or car accidents. They can also create a truly multi-modal transport system and promote innovation in society. A cooperative, linked, and automated mobility market across the region is also expected to lead to more new jobs than any other technological innovation so far. **The aim is to have fewer drivers but more complimentary services**. Three Seas Initiative has the opportunity to deploy Cooperative Intelligent Transport Systems (C-ITS) along its corridors to allow road users and traffic managers to share and use data to coordinate their actions, thus contributing to the development of pan-European connected and automated mobility. C-ITS¹³ is based on technologies that allow vehicles to communicate with each other and with the transport infrastructure. It allows all elements of the transport system to share information with each other.

Communication between vehicles, infrastructure and other road users is crucial for increasing the efficiency of future automated vehicles and their safe integration in the overall transport system. For example, SELIS Living Labs a project aimed at delivering a 'platform for pan-European logistics applications' achieved a 20 % increase in reliability and a 10% efficiency increase in rail, barge and truck logistics connectivity. In particular, a 30 % increase in load factor was achieved through collaborative transport all in all resulting in a 10% reduction of emissions. Respectively AEOLIX living labs project aimed at to develop a solution for connecting logistics information systems of different characteristics, intra- and cross-company, for immediate (real-time) exchange of information in support of logistics-related decisions, reached an average CO2 reduction of 17% being in some cases higher than 20%.¹⁴

Challenges emanate mainly from the fragmented deployment of C-ITS across EU countries. This creates barriers within the Single Market and can hamper the interoperability between different electronic systems and technological standards.

Although uptake of ICT can bring a lot of positive impacts to the transport sector, **some of the key challenges still remain. These are legal bottlenecks and fragmentation across the region; burdensome administrative procedures in the communication between authorities and businesses; lack of interoperable systems; limited use of digital transport documents and generally slow uptake of digitalisation**.

Today, the lack of coordination and harmonisation of freight transport documents at the international level causes costly processes and unnecessary procedures such as numerous submissions of the same information and duplicate information requests from authorities. This creates extensive red-tape for the trade and transport sector and also makes multi-modal operations difficult, as common standards for data exchange between different modes are lacking. **3S members should work closely on harmonising processes and the necessary IT framework to reach seamless mobility via digital means**. It is expected that the Regulation of the European Parliament and the Council on electronic freight transport information¹⁵ will help to reach this goal.



Fully digitalised and automated cross-border procedures are one of the most promising leading ideas for mobility that can be achieved in the near future. Digitalisation, if applied in a coordinated and harmonised manner, results in a high level of interoperability and simplification. A coordinated and synchronised approach has a great potential to improve performance, transparency and cost-effectiveness of cross-border operations for both companies and administrations. Many new sectoral programmes at national and EU levels aim to reduce red tape, as was noted at the 2019 Helsinki Digital

Transport Days Conference.¹⁶

Concepts such as the *data economy*, *mobility as a Service* (MaaS), *Corridor as a Service* (CaaS) or *just-in-time supply chains* are with great potential to disrupt current mobility trends and markets and launch them into full vertical and horizontal interconnectivity and interoperability. Digitalisation can and must facilitate the effective automation and seamless integration of all modes of transport to improve its efficiency and performance.¹⁷ The Three Seas Initiative approach should be framed by accessible technology and be dynamic and straightforward by deploying smart connectivity solutions and facilitating interoperability and data exchange.

Project example: FENIX Network¹⁸

FENIX will develop the first European federated architecture for data sharing serving the European logistics community of shippers, logistics service providers, mobility infrastructure providers, cities, and authorities in order to offer interoperability between any individual existing and future platforms.

The idea of FENIX comes from the work and recommendations of the European Commission's Digital Transport and Logistic Forum (DTLF) to create a viable and valid federative network of platforms as enabler for Business to Administration (B2A) and Business to Business (B2B) data exchange and sharing by transport and logistics operators.

Ultrafast networks and free flow of data can break down silos between transport modes

This endeavour needs substantial technological investments for it to become marketready. We need to build smart corridors, with IoT systems, where infrastructure is equipped with technology (such as intelligent sensors), which transforms it into a selfaware infrastructure that is capable of responding in real-time to external factors such as adverse weather conditions and giving other valuable information to its users.

Smart corridors have been primarily used to optimise trade routes via intelligent transportation systems. These systems assist authorities and businesses with the provisions for real-time traffic updates that enable proactive routing of the deliveries for on-time distribution of shipments. It also empowers parcel and package delivery companies to plan



and schedule their workforce accordingly proactively. This is a significant step towards improving logistics efficiency in the transport sector, reducing costs and enabling better utilisation of resources.

The infrastructure investments solely to 5G networks or IoT solutions along the corridors will remain hollow if not accompanied by the services layer. The smart corridors' concept is multi-layered and involves infrastructure, data and services. Investments are needed not only to make the infrastructure smart but also to enable businesses to develop services built on it. It also includes a paradigm of smart planning as a core enabler, which is an integral part of smart development.

Data availability and interoperability are crucial prerequisites for smart corridors' data services start-ups. The ever-increasing movement of goods and people is followed by a significant amount of information being passed between a variety of parties both in the private and public sectors. Most of this information is still printed on paper, in various forms. An unsatisfactory level of digital format presence, due to a lack of harmonised and secure ways to verify applicant authenticity, is currently one of the major disadvantages. Only 1% of logistics operations is accompanied by a fully digital information and documentation exchange. It is, therefore, essential that Member States' authorities are to be obliged to accept data in a machine-readable form, while the operators may, for the time being, use it voluntarily, in both B2A and B2B relations. The European Commission has put forward several regulatory proposals (ex. eFTI Proposal¹⁹⁾ to harmonise the interoperability obstacles and to overcome the issues.

Project example: Online Ship and Crew Certificates²⁰

The pilot addresses problems in the maritime sector, related to accessing Ship and Crew Certificates which are currently issued and maintained in paper format and sored by national Maritime Administrations.

Thanks to The Once-Only Principle Project (TOOP), the burden of proving the existence and validity of the certificates required for inspection by the Port State Control Office is transferred from the ship Master to the issuing authorities.

Within this pilot, TOOP connects the databases of national Maritime Authorities or internationally recognised classification societies and makes the information available to authorised parties. Furthermore, it automates a largely manual and paper-based procedure, as it introduces the possibility of online certificates, so that all interested bodies, such as port authorities, police and border guards, will be able to view and check them online. This will shorten the time for ship inspection, saving the time of the crew and making the whole process more efficient.

It is foreseen that through all its positive externalities, **a smart transport system will provoke several business-driven effects on Digital Single Market development and data economy**. The Helsinki 2019 Digital Transport Days Conference confirmed that with data, transport can take a customer-oriented approach breaking down silos between different transport modes and creating new business opportunities for European companies.

Smart mobility realises climate goals

It would be highly significant for 3S region stakeholders to utilise this data on a commercial basis, along with other data interoperability possibilities along connectivity corridors. Digitalising connectivity corridors by enabling cutting edge technology investments in a carrier-neutral way would convert to new economic frontiers and greener environment. The Joint Declaration of the Fourth Summit of the Three Seas Initiative (Ljubljana 5-6 June 2019) reemphasised the importance of sustainable development as Three Seas Initiative strategic response to the environmental issues of Europe and globally. Preservation of the regional water, land, air, energy and food resources will not be sustainable without the introduction of smart infrastructure in a climate goals perspective.

The challenge of sustainable transport is not only how to implement digital solutions and meet ever-growing



mobility demand, but also how to lessen the negative effects of transportation as a whole. Transport produces huge external costs linked to greenhouse gas (GHG) emissions, air pollution, congestion. Challenges in terms of decarbonisation are huge since transport represents 25% of the EU greenhouse gas emissions and within that share, 70% is due to the road sector (of which the majority is made up of personal cars). The transition to a sustainable transport system will deeply affect the way we operate, travel and do business.²¹

The way forward is to invest in smart technologies and forward-looking solutions to decrease the carbon footprint of mobility.

Cybersecurity facilitates modern mobility

The cost of cyber-attacks and malware are astronomical and continually rising. Smart Infrastructures comprise operators from different domains of activity that rely on connected devices, remote management, big data and systems which are under the risk of cyber threats with potentially high negative consequences for the safety of citizens, economies, public services and industries. Given that where there is risk, there is also an opportunity, the **digital security industry could benefit from a to-be demand for cybersecurity projects**. There is also room for optimism: Europe is ranked highest among world economies on cybersecurity development, according to the International Telecommunication Union, while 90% of cyber-attacks can be stopped with relatively simple cyber-hygiene.²²

Questions of security can best be managed through cooperation and therefore collaboration between all 3S countries, authorities, private and non-governmental sectors and other stakeholders/3S partners should be given high priority because current digital vulnerabilities threaten to undermine confidence in smart technologies.

In this manner, Smart Connectivity is not an objective *per se*; it will lead to the creation of new forms of connectivity and business opportunities. It is about *intelligence* as the foundation for changing the way we travel, providing a competitive advantage to our regions and fostering sustainable growth.

DISCUSSION POINTS

- What sort of smart mobility infrastructure we need to allow integrated multi-modal smart corridors to emerge in 3S region especially, if we want to enable autonomous transportation and vehicles?
- How should digital planning models/systems/approaches be done to predict future needs of mobility and how can the interoperability of infrastructure be ensured in this manner?
- How can we best incentivise or finance development of new mobility business models and services that would span the region?
- How to monetise hurdles coming from bureaucracy to enable digital procedures in PPP manner?
- How to ensure that digital documents and processes would be recognised for getting rid of paper bureaucracy in freight transportation (both B2B as well as with governments)?

FACTS & FIGURES

- Total freight transport in the EU has increased by almost 25 % over the last 20 years and is projected to further increase by 51 % during 2015-2050.
- The total time spent processing freight transport information is estimated today at almost 390 million hours / year. The digital exchange of freight transport information will save the business sector around 75-102 million hours / year.
- The transport sector employs more than 11 million Europeans and represents 5% of the EU's GDP.
- Transport represents 25% of the EU greenhouse gas emissions and within that share, 70% is due to the road sector (of which the majority is personal cars)
- Only 1% of logistics operations is accompanied by a fully digital information and documentation exchange. However, their share varies depending on the transport mode. The estimate draws on the Ecorys et al. (2018) impact assessment support study.
- Logistics applications can bring a 20 % increase in reliability and 10% in efficiency increase in rail, barge and truck logistics connectivity.
- A 30 % increase in load factor can be achieved through digitalised collaborative transport all in all resulting in a 10% reduction of emissions.

HIGHLIGHTS

- Digital real-time ecosystem for logistics can be established today if best practices would be utilised cross corridors in good collaborative faith.
- While the EU is to intervene on regulatory de-fragmentation, Three Seas Initative can encourage de-fragmentation of the IT environment of transport corridors. Digital interoperability and multi-modality come as a highly forward-looking solution for fighting fragmentation.
- There are numerous opportunities to improve the quality and efficiency of transport infrastructure in the eastern regions of the EU.
- The infrastructure investments to 5G networks or IoT solutions along the corridors will remain hollow if not accompanied by the services layer.
- It would be highly significant for 3S region stakeholders to utilise this data on a commercial basis, along with other data interoperability possibilities along

connectivity corridors.

- The key challenges are legal bottlenecks and fragmentation across the region; burdensome administrative procedures in the communication between authorities and businesses; lack of interoperable systems; limited use of digital transport documents; slow uptake of digitalisation.
- Fully digitalised and automated cross-border procedures are among the most promising leading ideas.
- The challenge of sustainable transport is not only how to implement digital solutions and meet ever-growing mobility demand, but also how to lessen the negative effects of transportation as a whole and change attitudes.
- New economic frontiers can be discovered for a better commercial and climate environment through digitalising connectivity corridors by enabling cutting edge technology investments in a carrier-neutral way.

Smart Energy

Smart Energy System is a cost-effective, sustainable and secure energy system in which renewable energy production, infrastructures and consumption are integrated and coordinated through energy services, active users and enabling technologies.²³ The most distinctive traits of the smart energy system are sustainability, reliability, efficiency, cost-effectiveness, integration and intelligence. Smart energy management is about providing smart energy services. Creating market-based services is one of the three cornerstone objectives of EU energy policy.²⁴ European citizens are central actors in the transition to a smart energy system. Efficiency in energy, achieved through the smart utilisation of digital enablers, leads to economic success and competitiveness. The smart energy system of the future will be a consumer-centric one in which citizens take on the role of proactive decision-makers and market-influencers in a digitalised and decentralised system by becoming prosumers - consumers and producers at the same time. The smart energy concept directly addresses the environmental impact of the energy and transport sectors but also creates opportunities for the economy, especially the circular economy and the creation of green jobs.

Building on better use of clean and innovative processes and tools, the road to system integration will also stimulate new investments, jobs and growth, and improve EU global industrial leadership. It can also be a building block of the post-COVID-19 economic recovery. As part of its efforts to unlock innovation in key clean technologies and value chains and increase economic resilience, the European Commission's recovery plan proposed on 27 May 2020 highlights the need to better integrate the energy system. The EU long-term strategy of achieving carbon neutrality by 2050, the Energy Union



Strategy, the "Clean Energy for all Europeans" package and the Strategic Energy Technology Plan – the technology pillar of the European Energy Union – form an important framework for the 3S smart energy initiatives.

Investments in smart energy drive the development of a green, de-carbonised economy, research and innovations, a new generation of renewable energy technology, industrial competitiveness, and jobs creation in the low-carbon energy sector. A gradual, clean and fair energy transition and the creation of a pan-3S integrated energy system will bring considerable spillover effects and benefits at all levels of the regional economy from several perspectives.²⁵

The transition requires the mobilisation of both the public and private sectors in the 3S regions and their partners towards funding this multifaceted opportunity ahead. Investments in digital infrastructure and smart grid technology should be encouraged and rewarded by the individual States.

Prosumers will make our region energy-efficient and resilient

The smart energy system is also often described as a smart consumer-centric energy system where citizens are proactive decision-makers and market-influencers in a digitalised and decentralised system by becoming prosumers. Such a system empowers end-users by increasing connectivity and data accessibility. The European Technology & Innovation Platforms for Smart Networks for Energy Transition (ETIP SNET²⁶), envisions that by 2050 several million households will actively participate in real-time, automated demand response (electricity, heating and cooling) with connected appliances and equipment, in addition to the existing and emerging solutions for industry and commerce.

There are numerous opportunities for different business cases based on prosumers data coming from the grid. Either to provide additional value-added services based on the real-time info (better service, insurance, lifestyle services etc.) or energy facilitation to all. Data is in the core of the smart energy grid, and it should flow along the corridors across borders to empower users and the economy.

The ongoing transformation to smart energy integrates energy storage and power conversion within the various energy carrier grids using the electricity system as its "backbone". The International Energy Agency has taken the following stand that the development of smart grids is essential if the global community is to achieve shared goals for energy security, economic development and climate change mitigation. **Smart grids enable increased demand response and energy efficiency, integration of variable renewable energy resources and electric vehicle recharging services while reducing peak demand and stabilising the electricity system²⁷.**

A significant obstacle to foster the full potential of smart grids comes from the lack of cross-border digital interoperability of the grids, which prevents the cross-border or inter-regional energy market to achieve better energy consumption and security. Cross-border digital interoperability for smart energy is Three Seas Initiative major area of interest.



Big data facilitates grid management

Access to customers' energy usage data expands demand response and improves energy efficiency.²⁸ **Smart energy grids cannot function without high-performance data centres** for data acquisition, storage and utilisation. Data from smart meters, phasor-measurement units, billing, weather sensors, and intelligent electronic devices are beneficial for many advanced applications, such as predictive analytics, demand-side management, grid awareness, outage detection, asset management, and theft detection. Smart grids will increasingly make use of local storage technologies and demand-side management, which could offset the need for new transmission and distribution lines.²⁹

Project example: Energy Data Bridge Alliance³⁰

The Alliance aims to create a standard access point to Europe's smart meter data for energy services companies. It is currently being prepared by the grid operators from eight European countries. We aim to connect all of Europe's smart meters by 2023.

Access to smart meter data is needed for energy efficiency solutions, siting of distributed energy resources, flexibility and other business models. Access to data makes these business models easier and more efficient. However, today access to smart meter data is challenging and fragmented in Europe. By making all smart meter data accessible from one place, the Alliance will remove market barriers and increase competition.

The European Network of Transmission System Operators for Electricity estimates investments for required in transmission grids, interconnectors, distribution grid and smart components of the order of EUR 500 billion by 2030. It will also be important to invest in interconnections, especially to integrate the growing share of renewable energies, to smooth out their variability and to reduce the need to add conventional power capacity.



Continuous energy efficiency improvements offset the energy demand generated by the growth of data centres and the development of mobile networks (with the advent of the next generations of high-speed communication) which consume more energy than fixed-line networks at the same datatraffic rate. Scaling-up effects are realised through larger data centres and optimised capacity utilisation. Non-avoidable waste heat from data centres could be re-used in district heating networks to reach the goal of a circular economy. Data production excess heat can be saved in hydrogen if no better alternative is available.

Smart energy sparks new business models

Due to a rather long value chain of energy as a service concept, smart energy development and implementation produce a broad circle of positive socio-economic externalities; thus it is foreseen that numerous business opportunities will exist along the smart energy corridors.

The Smart Energy concept directly addresses the environmental impacts of the energy and transport sectors but also creates opportunities for the economy, especially circular, and green jobs. Five dimensions of the EU's Energy Union - fullyintegrated internal energy market, supply security, energy efficiency, emissions' reduction and research and innovation in low-carbon technologies – provide the momentum for setting up a collaborative framework within Three Seas Initiative to accelerate the development and deployment of smart energy technologies in a coherent manner for new business opportunities. Efficiency in energy equals economic success and competitiveness, which can be achieved by smart utilisation of digital enablers. Significant progress is expected from the revision of both the Directive and Regulation on the EU electricity market. The expected changes in legislation will allow electricity to move freely throughout the EU energy market through cross-border trade, more competition and better regional cooperation; enable more flexibility to accommodate an increasing share of renewable energy in the electricity grid; foster more market-based investments in the sector; de-carbonise EU energy system. Also, **the technical process of switching suppliers must take less than 24 hours in all EU countries by 2026 at the latest³¹, which means that smart enablers should be deployed** *en masse* **to make it happen.**

Furthermore, the revision of the European Commission Energy Performance of Buildings Directive will: (a) introduce building automation and control systems as an alternative to physical inspections; (b) deploy smart readiness indicators for buildings to enhance their energy efficiency and other performance characteristics – namely by assessing their ability to interact with occupants and the grid; and © use building codes to support the roll-out of recharging infrastructure for e-mobility.

Security and privacy by design

Smart grid creates new layer of complexity in terms of security as well as for privacy. **Right for privacy should be guaranteed to all stakeholders**, especially information from smart meters about the consumer (and prosumer) energy and service use. This is supported by citizen's rights to allow (or not to allow) access to their data by third parties in all cases beyond the needs of system operators for carrying out their institutional duties. In any case, all processes and their management should be interoperable and certified to account for all possible cases where system security measures may impact privacy.³²

Privacy and cybersecurity are intertwined matters which are necessities of modern systems. With the digitalisation of the grid, we are of course also forced to think about the grid cyber-security. **Rather than an obstacle, the issue of security should be taken as enabling feature and not as a threat**. To minimise vulnerability to cyber-attacks even under the strong growth of IoT and rapid changes in digital technologies and decentralisation, energy carrier systems, particularly electricity systems, will be operated in real-time which implies specific security precautions. **A system-wide resilience would be needed to develop, supported by 'cyber hygiene and security by design' approaches** (according to the 2017 IEA Digitalisation and Energy). The European Commission has stated in its strategy "Powering a climate-neutral economy: An EU Strategy for Energy System Integration" that it will develop a Network Code on cybersecurity in electricity with sector-specific rules to increase the resilience and cybersecurity aspects of cross-border electricity flows, common minimum requirements, planning, monitoring, reporting and crisis management (by end 2021). It is expected to address the regulatory gaps and creates a collaborative and enabling platform for development.

DISCUSSION POINTS

- How to create cross-3S region smart grid what are barriers and prerequisites?
- How to create a pan-3S-integrated energy system or market and how to bolster it with data exchange? Are there regulatory issues?
- How to use novel financing mechanisms to give boost for innovative renewable energy technology development and uptake?
- Can we use financing mechanisms or regulation or other means to push for energy efficiency via smart solutions?
- What kind of smart services for prosumers will guarantee the vitality of this system, and how?

FACTS & FIGURES

- At least 170-180 million smart meters are installed in the EU-27 by 2020 at the cost of at least EUR 30 billion (EC/JRC 2013.)
- The current environmental footprint of the ICT sector is estimated to be between 5 and 9% of the world's total electricity use and more than 2% of all emissions, a large part of which is due to data centres, cloud services and connectivity.³³
- European hydrogen strategy and, in particular, its investment agenda and industry blueprint, estimates investments of €430 billion to be made by 2030 into clean hydrogen.³⁴
- In the last 5 years, there are only 36 multi-national smart grid implementation projects across Europe, out of which 5 are in 3S countries.

HIGHLIGHTS

- Smart energy management is about providing smart energy services.
- A gradual, clean and fair energy transition and creation of a pan-3S integrated energy system would bring considerable spillover effects and benefits at all levels of the economy and from all perspectives.
- Investments in digital infrastructure and smart grid technology should be encouraged and rewarded by the States.
- The future smart energy system is also named a smart consumer-centric energy system where citizens are proactive decision-makers and market-influencers in a digitalised and decentralised system by becoming prosumers.
- It will also be important to invest in interconnections, especially to integrate the growing share of renewable energies, to smooth out their variability and to reduce the need to add conventional power capacity.
- Three Seas Initiative should invest in developing and uptake of four inter-connected and inter-related layers: market layer; communication layer; physical system layer; and digital infrastructure layer³⁵
- Efficiency in energy leads to economic success and competitiveness, which can be achieved by smart utilisation of digital enablers.
- The Smart Energy concept directly addresses the environmental impacts of the energy and transport sectors but also creates opportunities for the economy, especially circular, and green jobs.
- Cyber-security should not be seen as an obstacle or threat; rather, cyber-security should be seen as an enabling feature.
- Data is in the core of the smart energy grid and it should flow along the corridors across borders to empower users and the economy.

Summary

The Three Seas (3S) region is facing a series of interconnected challenges in relation to the expansion of digitalisation to improve the competitivity of the region and reduce its carbon footprint. Significant investment in connectivity infrastructure is needed, notably in the transport, energy and digitalisation sectors. **Investment in these sectors will lead to the decarbonisation of the economy as a cross-cutting theme and will have a significant spillover effect to overall economic growth.** The three challenges of increasing connectivity, de-carbonising the economy and pushing forward digital transformation can best be tackled by working together and ensuring that the efforts of the 3S regions are both efficient and sustainable.

The COVID-19 pandemic is an evolutionary time of awakening. It has disrupted the very basics of our society, stressing our economies to the bones and testing the capacities of regional cooperation. Digital governance and e-services have proven to be essential for security and well-being at these times. We should address these questions together to be competitive on a global scale as a region.

The overall vision for 3S digitalisation is to **expand digital components across key infrastructure**, which will in turn support **new business models** and technologies, such as real-time economy management, renewable friendly smart grid, smart energy management, smart logistics and traffic management.

Harnessing the dynamics of our competitive and free markets is the most economical way to achieve our **energy and climate goals**. Making use of existing digital tools from our region by sharing and integrating the digital foundations of energy markets and thereby removing barriers to entry for innovators is essential. For example, harmonised, easy and secure access to consumer data by consent (*ex. MyData initiative*³⁶) is a prerequisite for a large number of energy and mobility initiatives. This smart connectivity layer is needed in addition to investments in infrastructure to ensure competitive energy markets.



The Three Seas Initiative as a **like-minded group working towards the deployment and uptake of digital services enablers** in listed connectivity **projects has the potential to become a digital investment and discussion platform**. In order to fulfil this potential, the Three Seas Initiative needs **greater coordination and alignment between its priority projects**. Ultimately, if governed consistently and sustainably, this coordination can create a virtuous cycle of investment and innovation, positioning the 3S members as leaders in the global green economy.

Smart Connectivity is a push for linking our energy and transport infrastructures physically, hand in hand, by developing, adopting and linking digital platforms and services that allow for the best management of linked infrastructures. **Smart Connectivity is a multi-layered way of thinking of intertwined topics such as services, data and infrastructure sitting on top of the three areas.** The three key areas in which Three Seas Initiative should promote digitalisation. Smart enablers as the core of the digitalisation challenge, which underpin the development of the other domains.

It encompasses smart planning that includes digital planning and data models that enable efficient creation of complex solutions and validation of design decisions end to end. Digital services and data interoperability for seamless digital services, supported with digital identity usage; a singular digital identity for every citizen, based on the elDAS (Identification, Authentication and trust Services) framework for online transactions and legal certainty. Backed with common and resilient cyberspace for our digital economy. This is a cross-cutting layer for different domains and is a core for Smart Mobility and Smart Energy. The respective areas are concentrating on mobility opportunities arising from digitalisation and Smart Energy, describing the outlook for a greener and prosumer-oriented real-time energy market outlook. **The idea of Smart Connectivity can flourish if there is political will, investments and good coordination**.

The Three Seas Initiative has the potential to become an innovation uptake spearhead for smart corridors. The Three Seas Initiative has identified ten national and multilateral Priority Interconnection Projects in the 3S region with strong digitalisation ambition. However, there are endless opportunities in terms of server park development, cybersecurity applications, interoperable digital services for logistics or even 5G or IoT infrastructure solutions. The Three Seas Initiative can establish an accelerator type of framework for digitalisation projects and renew the list of digital projects by collecting new project ideas that would be scalable and services-oriented.

If listed and future projects are collaboratively designed and executed, new projects are generated, collected and added, digitalisation level of the region can become a competitive edge that will put the 3S countries in a favourable position Globally. Smart planning will help to attune infrastructure projects with environmental needs and to better align resources with the data flows enabled by the smart infrastructure.

It is imperative that 3S countries develop a strategic agreement enabling them to act as a like-minded region regarding which technologies to embrace and how to establish a real-time digital ecosystem for smart connectivity. The 38 non-digital projects in the transportation and energy sectors have the potential for digital layers or can be considered as a potentially highly valuable source of data if IoT or other digital enablers are deployed in a coordinated way. Cooperation and the sharing information and good practice is also the way forward in terms of finding support and funding for the projects.

In the eastern regions of the EU, the quality and efficiency of transport infrastructure needs to be improved and requires investment. The challenge of sustainable transport is not only how to implement digital solutions and meet ever-growing mobility demand, but also how to lessen the negative effects of transportation as a whole. Digitalising connectivity corridors by enabling cutting edge technology investments in a carrier-neutral way, can lead to the discovery of new economic frontiers for a better commercial and climate environment.

The infrastructure investments in 5G networks or IoT solutions along the corridors will remain hollow if not accompanied by the services layer. In order to speed up the return on investment, regional stakeholders in the Three Seas Initiative should start using this data on a commercial basis, along with other data interoperability possibilities as soon as possible.

However, currently, the key challenges are legal bottlenecks and fragmentation across the region; burdensome administrative procedures in the communication between authorities and businesses; lack of interoperable systems; limited use of digital transport documents; slow uptake of digitalisation. **Fully digitalised and automated cross-border procedure is one of the most promising leading ideas to take action now.**

Nowadays, all actions are driven by the urgency of the climate crisis. A gradual, clean and fair energy transition and creation of pan-3S integrated energy system would generate considerable spillover effects and benefits to all levels of the economy and from all perspectives. Investments in digital infrastructure and smart grid technology should be encouraged and rewarded by the governments of the States. **It would be beneficial for the Three Seas Initiative to invest in developing and deploying four inter-connected and inter-related layers: the market layer; communication layer; physical system layer; and digital infrastructure layer.³⁷**

Smart energy management is about providing smart energy services. **The future smart** energy system is also known as the smart consumer-centric energy system where citizens are proactive decision-makers and market-influencers in a digitalised and decentralised system by becoming prosumers (consumers and producers at once). The Smart Energy concept directly addresses the environmental impacts of the energy and transport sectors but also creates opportunities for the economy, especially the circular economy and the creation of green jobs. Efficiency in energy, achieved through the smart utilisation of digital enablers, leads to economic success and competitiveness.

The European Commission has taken many forward-looking steps to support digitalisation with regulatory ramifications and standardisation and by supporting collaborative initiatives. Better regulation in the form of enabling regulation is the way forward. **While** the EU is to intervene on regulatory de-fragmentation, the Three Seas Initiative can encourage the de-fragmentation of the IT environment of transport corridors and energy systems by better coordination and collaboration.

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