ANALYSIS

CLIMATE CHANGE, ENERGY AND ENVIRONMENT

SMART CITIES AND ENERGY TRANSITION

Can one happen without the other?

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Smart City initiatives in Croatia are predominantly local initiatives which happen to be driving the energy transition forward. There is neither a common national governance on Smart City development, nor a common deployment strategy.

An innovative energy financing mix which includes new sources of finance and upgraded ownership models would increase the implementation of sustainable energy projects and help achieve the sustainability goals.

The magnitude of the impacts of climate change presents a unique opportunity for innovation in technology projects, funding mechanisms, stakeholder interaction and knowledge sharing mechanisms.

FRIEDRICH EBERT STIFTUNG

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INTRODUCTION

In 2015, all the Member States of the UN adopted the 2030 Agenda for Sustainable Development in a historic call to action that is hinged on care for people and planet, based on global partnership. In December 2019, the European Commission announced a new growth strategy, the European Green Deal (EGD). This strategy is envisioned to support the Sustainable Development Goals (SDGs), and enable a smooth transition to a just and prosperous society, with a resource-efficient and competitive economy, which will have no greenhouse gas emissions (GHE) by 2050.

Cities and local communities have a major role to play in this transition. Over two-thirds of the world's population are likely to live in urban areas by 2050. Cities currently account for 60-80 percent of energy consumption, and generate as much as 70 percent of human-induced greenhouse gas emissions. [1] Given the overlapping nature of the SDGs, issues with implementation, and the fact that cities and local communities require integrated investments in infrastructure, urban services, as well as resilience to climate change, successful implementation proved difficult. However, the updated thinking highlighted in the Sustainable Development Solutions Network (a global initiative for the UN)[1],is for the SDG implementation to be reframed into six integrated transformations, as shown in Figure 1 below.

The six transformations show the strong overlaps, and could help in operationalising the SDGs through collaboration of relevant parts of governments with civil society, business, and other stakeholders. [2] It should be noted that transformation areas 3 and 5 cut across all 16 SDGs. Such multidimensionality is key to localisation and implementation, despite the particular sets of challenges it brings along with the opportunities.

As a step to strengthen cities as actors of these transformation, a mission on 'Climate Neutral and Smart Cities' has been initiated under the Horizon Europe programme. It aims to help cities become more resilient and smarter by empowering citizens in digital-social innovation and in policymaking. However, as new terminologies and buzzwords such as blockchain, circular economy, 5G, digitalisation, AI, green transition, etc. have become common place, the question of the practical meaning of these terms and how they fit into national and sub-national contexts inevitably arise.

Considering that all 6 transformation areas (shown in Figure 1) coincide with the growth and development objectives of local communities, this brief examines:

- how the objectives of the EGD align with the European digital strategy and national development objectives and strategic plans,
- the role of national digitalisation agenda and local Smart City ambitions in low-carbon transition and resilience,
- financing models and investment ecosystems, as well as
- challenges and opportunities of implementing Smart City strategies

This essay attempts to mitigate the risk of having unimplementable, but well-articulated, high-level strategies and plans, by connecting the dots between global goals, game-changing industry trends and local realities.

1 The paper "Six Transformations to Achieve the SDGs," published on 26 August in the Nature Sustainability journal, builds on the 2018 report of The World in 2050 Project to propose an action agenda for implementing the SDGs. It was written by Jeffrey D. Sachs (Columbia University), Guido Schmidt-Traub (Sustainable Development Solutions Network), Mariana Mazzucato (University College London), Dirk Messner (United Nations University), Nebojsa Nakicenovic (International Institute for Applied Systems Analysis), and Johan Rockström (Potsdam Institute for Climate Impact Research).

Figure 1 From 17 goals to 6 transformation areas

1. EDUCATION, GENDER, AND INEQUALITY
   SDGS 1, 5, 7-10, 12-15, 17
2. HEALTH, WELLBEING, AND DEMOGRAPHY
   SDGS 1, 2, 3, 4, 5, 8, 10
3. ENERGY DECARBONIZATION AND SUSTAINABLE INDUSTRY
   SDGS 1-16
4. SUSTAINABLE FOOD, LAND, WATER, AND OCEANS
   SDGS 1-3, 5, 6, 8, 10-15
5. SUSTAINABLE CITIES AND COMMUNITIES
   SDGS 1-16
6. DIGITAL REVOLUTION FOR SUSTAINABLE DEVELOPMENT
   SDGS 1-4, 7-13, 17

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THE EUROPEAN GREEN DEAL, NATIONAL POLICIES AND DIGITALISATION

The EGD presents a holistic agenda that recognises the necessity to incorporate environmental and climate objectives into the major sectors of the economy and as such, provides instruments and financing for cities to stimulate and manage transformations. These sectors are not static though, they are being disrupted by the digitalisation trend, among others. The main challenge is how the EGD would smoothly transform the economies of all 27 Member States to a low-carbon one, without reducing prosperity, while simultaneously improving the quality of life of the people, via pollution reduction, better health, etc.

OVERLAPPING EU POLICY AREAS

The EGD, which is an integral part of the present Commission's strategy to implement the United Nation's 2030 Agenda and the SDGs, [3] **presents a long-term roadmap to climate neutrality.** In March 2020, the Commission adopted the EU industrial strategy to address the twin challenges of the green and digital transformation. The communique noted that Europe must leverage the full potential of digital transformation, which is a key enabler for reaching the Green Deal objectives. [4] Thus, the EGD relies on two major initiatives in the near term:

a) Horizon Europe Programme, and
b) the Digital Europe Programme.

There are overlaps in several thematic areas addressed by the Horizon Europe and Digital Europe programmes. Both cover high performance computing, artificial intelligence and cybersecurity. Horizon Europe will be the sole centrally-managed EU programme supporting R&D, and would be the main programme for demonstration, piloting, proof-of-concept, etc., including pre-commercial deployment. Whereas the Digital Europe programme will be focused on large-scale digital capacity and infrastructure building, with the objective of wide uptake and deployment of tested, innovative and interoperable digital solutions for cities and communities across Europe.

CROATIAN NATIONAL POLICY FRAMEWORK

As elaborated in the Friedrich-Ebert-Stiftung publication on Institutions and Coordination Mechanisms for the European Green Plan[2], the Croatian Climate policy is determined by the Law on Climate Activities and Ozone Layer Protection (Official Gazette, No. 127/2019), which stipulates the basic documents on climate change and the protection of the ozone layer to be:

I. Low-Carbon Development Strategy of the Republic of Croatia
II. Climate Change Adaptation Strategy in the Republic of Croatia
III. Action plan for the implementation of the Low-Carbon Development Strategy of the Republic of Croatia
IV. Action plan for the implementation of the Climate Change Adaptation Strategy in the Republic of Croatia
V. Integrated energy and climate plan of the Republic of Croatia

However, top hierarchical and strategic documents that would enable implementation of the EGD are missing. Most significant are (i) the National Development Strategy, a roadmap to guide the EGD implementation process, which is expected to be adopted very soon, and (ii) the Low-Carbon Development Strategy, which is still pending after eight years. [5]

Croatia is still not showing an unequivocal political commitment to decarbonisation, despite the country's vulnerability to the effects of climate change, particularly in the islands. There are major issues with the coherence of the various strategic and implementation documents, in addition to their sheer volume. Without clarity in these documents, the goal of climate neutrality by 2050 would be unachievable, despite the availability of the Integrated Energy and Climate Plan, which indicates the strategic direction for the next decade.

2 A.-M. Boromisa, "Institutions and coordination mechanisms for the European green plan," Friedrich Ebert Stiftung, Zagreb, 2020.

The Energy Strategy of the Republic of Croatia should provide clear guidelines on the trajectory of the energy transition. It, however, considers two scenarios without any defined goals or clear overarching targets that would provide necessary structure for such transformation with economy-wide impacts. **The development of carbon-free electricity is pinpointed as the solution to the energy transition, but the fundamental question of which energy mix to adopt is still open.** The energy mix is a matter of energy policy. Incorporating more low-carbon energy sources into the mix raises questions of how to deal with the challenges of the intermittency and the cost of harnessing renewable energy sources (such as wind and solar energy), which makes it necessary for there to be other energy sources to supplement them. An optimal energy mix should be technologically agnostic and allow for the introduction of new, innovative ideas.

Given that both decarbonisation and Smart City objectives rely on digital transformation, the development of a digital society has become vital. Croatia still lags EU peers in digital development. The Digital Society and Economy Index (DESI) 2020 ranks Croatia 20th of EU 27, indicating that there is need for speedy improvement to effectively harness the potential of digital transformation.

PRIVATE SECTOR POSITION

The EGD makes provisions for incentives to encourage private sector investment, with action plans for key sectors to meet such goals as waste reduction, improved use of resources, etc. Additionally, the energy transition and digital revolution are boosting energy efficiency and creating new business opportunities. **Digitalisation, decarbonisation and diversification are the three core areas that underpin the energy transition.** Distributed energy resources (DER) from Renewables also characterise the energy transition, alongside the rise of new uses such as electric mobility and self-consumption of electricity. **This transformation requires heavy investments to develop more flexible power grids and IT infrastructure to manage the associated data in an increasingly complex energy system.**

The private sector has been assigned the role of driving the energy transition forward. The Croatian Energy Strategy recognises that the energy transition process will be capital intensive. State aid is expected to be reduced and the private sector and capital investors should be more involved in financing renewable energy projects. Smart City strategies and initiatives at regional levels also look to the private sector investments as partners to fulfil the objectives. **However, private sector actors and the public sector often have vastly different priorities, different paces, and different approaches to work.**

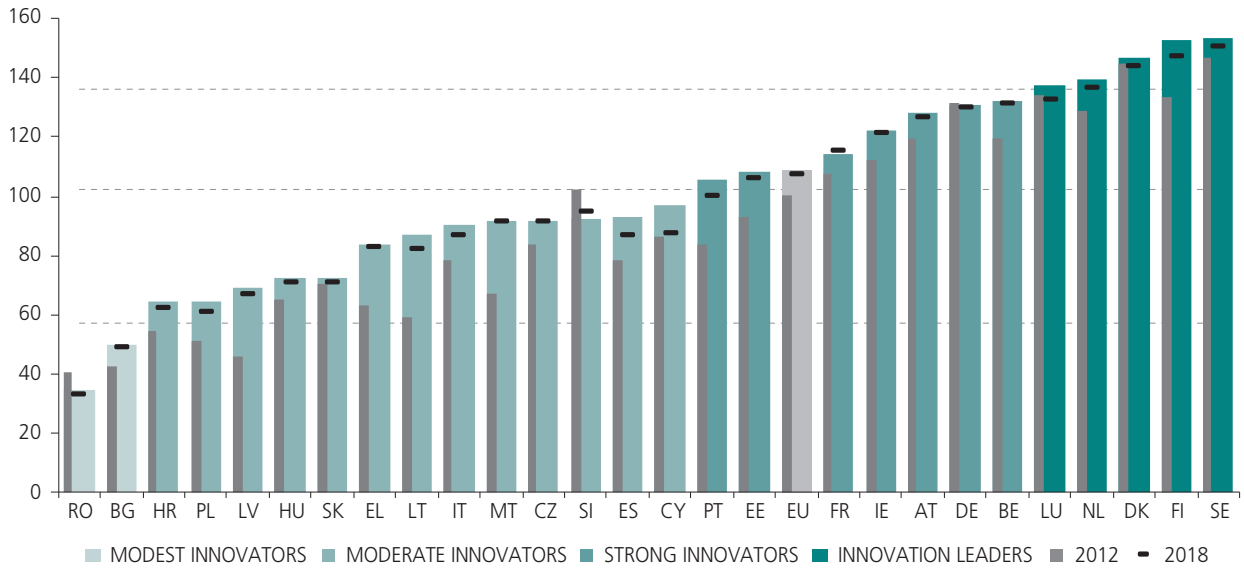
Digital technologies with their rapid diffusion, have radically transformed business models and entire sectors. The internet, mobile phones, and all other tools to collect, store, analyse, and digitally share information are relatively cheap, easy to use and provide immediate private benefits. In theory, internet-based services drive marginal transaction costs to zero and create good competition. In practice, however, **a number of regulatory and competition policy issues have emerged with digital transformation to challenge the authorities.** Issues like regulating new financial service providers (Fintech), or limiting the abuse of market dominance by large platforms and dominant multinational market players remain open. **Thus, the digital revolution fosters new business models that could be beneficial to consumers, but not when inadequate regulations, including in service sectors, and powerful incumbents prevent market entry.** [6]

RESEARCH, DEVELOPMENT AND INNOVATION (R&D&I)

To develop and scale up solutions to climate change, investment in R&D&I is critical. Especially relevant are solutions that are focused on energy-efficient technologies, carbon-free energy technologies, energy storage technologies, smart grids, CO2 removal and CO2 reuse technologies. Some EU companies innovate through digital energy efficiency solutions to optimise the overall energy system costs and to enable customers to better use energy in optimal ways, such as demand-side response, new personalised energy services and e-mobility. This segment is at the core of both the energy transition and smart community development. Overall, research and development counts among the largest potential factors contributing to GDP growth. However, **investment in research, development and innovation as related to low-carbon development in Croatia has been negligible so far**. R&D is also insufficiently recognised in strategic documents, and poorly accessible to the private sector.

Croatia's overall innovation performance places the country at the very end of the group of moderate innovators (see Figure 2) The latest report on innovation performance based on the composite indicator of national innovation system performance, categorises member states within four groups: Innovation Leaders, Strong Innovators, Moderate Innovators, and Modest Innovators. [7]

Figure 2
Performance of the innovation systems of EU Member States



In Figure 2, coloured columns show countries' performance in 2019, using the most recent data for 27 indicators, relative to that of the EU in 2012. The horizontal hyphens show performance in 2018, using the next most recent data, relative to that of the EU in 2012. Grey columns show countries' performance in 2012 relative to that of the EU 2012. For all years, the same measurement methodology has been used. The dashed lines show the threshold values between the performance groups. [7]

At 0.5% of GDP, business R&D expenditure in Croatia is among the lowest in the EU. [8] Companies in Croatia invest considerably more in non-R&D innovation than in R&D-driven innovation, limiting the export of knowledge-intensive services. R&D target set in the 2020 National Reform Plan is 1.4% of GDP, however, Croatia is not on track to meet the target. [8]

Additionally, low performance is recorded in the exports of knowledge-intensive services as a percentage of total services exports compared to peer countries. [7] **The under-investment in knowledge assets also has a direct impact on Total Factor Productivity (TFP), because it limits the degree of product differentiation and unfavourably impacts potential competitiveness.**

There is an urgent need to boost the entire R&D&I system in ways that would bring the country closer to the EU average. Easier access to funding should be provided to the private sector, for applied and scientific research, pilot and demonstration projects. Such projects should be catalogued, monitored and tracked to prevent misuse of funds, as well as the proliferation of technologies developed for the grant instead of the market.

THE PEOPLE ASPECT

A new dimension to the Smart City discussion was introduced by Dan Hill in his essay titled "A manifesto for smart citizens" where he argued that: *"Instead of the smart city, perhaps we should be more preoccupied with smart citizens. The smart city vision tends to focus on infrastructure, buildings, vehicles, looking for a client amidst the city governments that procure or plan such things. But the city is something else. The city is its people.* ***We don't make cities in order to make buildings and infrastructure. We make cities in order to come together, to create wealth, culture, more people****".* [9]

CITIZEN-CENTRICITY

In both Smart City initiatives and the low-carbon transition, the necessity for inclusion and people-centricity is ever present. However, the meaning of citizen-centricity in practical terms is rarely articulated. Current knowledge on citizen involvement in smart city initiatives is limited and available literature on smart cities comprise few empirical case studies.

Based on a case study in Dublin, scholars Cardullo and Kitchin found that citizens are most often involved in Smart City initiatives in the form of non-participation, consumerism or tokenism. [10] This means that citizens are often involved passively, rather than as active, engaged participants. In assessing the significant variations in the positioning of citizens, the service-user (consumer) is most favoured, followed by the entrepreneurial citizen. Civic and political modes of participation are less embraced, and are often only accommodated in a tokenist manner. [11]

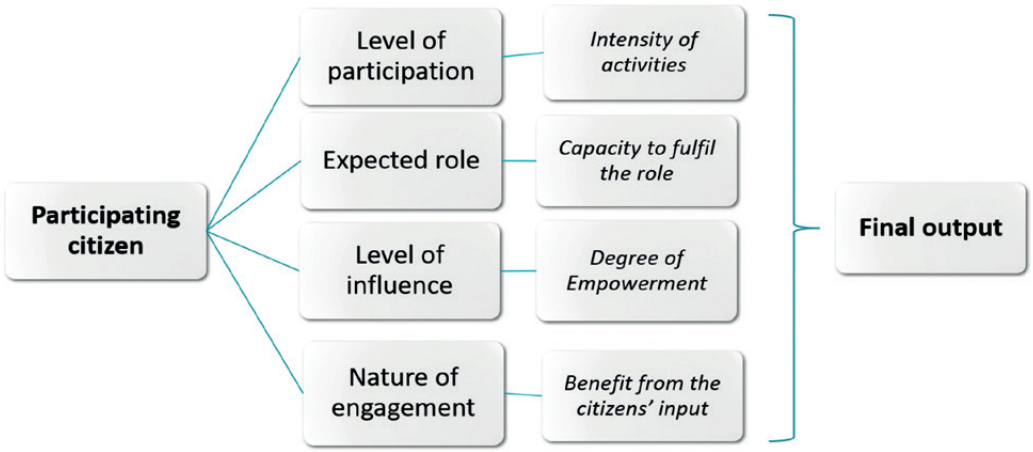
Citizen participation in technological transition is often shaped by local realities. The diagram below can help determine the positioning of a citizen joining any Smart City initiative, by articulating the expected level of participation, assigned role, level of influence and the particular nature of that citizen's engagement.

The context of involvement of diverse groups in an initiative will help shape the development trajectory and impact the final output in interesting ways.

BEHAVIOURAL CHANGE

A sustainable energy transition involves changes in a wide range of energy behaviours that may go against personal habits and comfort levels. Sustainable ecosystems need to use transformational socio-tech designs to influence citizens' attitudes and lifestyle choices. These systems will incentivise and encourage the adoption of greener solutions, such as bikes or ride sharing, instead of individual cars, and in that way the community could help the individual play an active role in their new low-energy environment.

Figure 3
Determining the characteristics of citizen involvement in smart city initiatives



Source: author's graphical interpretation of concepts by Cardullo and Kitchin.

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SMART TRANSITION

Smart City initiatives and the EGD are both driven by the development of sustainable societies. Digital technology is an enabling tool. Smart City initiatives can be classified into "top-down" and "bottom-up" approaches. [12] The top-down approach focuses on technology, efficiency and master planning. It integrates data from different systems into a single operations centre. Whereas the bottom-up approach focuses on citizens' use of innovative technologies, such as mobile applications and open data, to create solutions to issues that matter to them, and effect change.

WHAT MAKES A CITY/DISTRICT/ COMMUNITY SMART?

While there still is no standard definition of a Smart City, the term "Smart City" has displaced "sustainable city", "future city" and "digital city. It describes the deployment of smart technologies and data i.e. information and communications technology (ICT) solutions to address sustainability challenges such as economic, social and environmental issues. Generally, the image that springs to mind when one hears of Smart Cities is often in line with the ideas of tech industry leaders such as Cisco, IBM and Siemens, who believe that more intensive use of technology and data will enable government leaders to make better decisions. Most available literature on smart cities often highlights high-tech ideas such as variable pricing for tolls, efficient street lighting, automated revenue collection, e-governance, etc., as the hallmark of a Smart City. However, many of these expensive actions, which are only available to richer communities, often overlook smart, non-digital ideas such as shared infrastructure. [13]

> "Smart cities rely on integrated and interconnected strategies and systems to effectively provide better services and increase quality of life, ensuring equal opportunities to all and protecting the environment. A smart city continuously strives to improve social, economic and environmental sustainability outcomes." – International Standards Organisation.

A Smart City actively engages in the development of government, people, industry, infrastructure, education, and social services, with foresight on the future needs of the city. This allows the city to provide services and infrastructure that address both the current and future needs of its residents, which is not an easy task. As a city grows, expansion and upgrade of critical infrastructure such as energy, transport, water, etc., become unavoidable. Cities are in constant competition with other cities for investment and talent, and must simultaneously deliver essential services to citizens. The additional challenge of a modern city is how to boost the local economy while reducing the use of natural resources and cutting GHE.

SUSTAINABILITY AND SMART CITIES

In the past decade working on Smart City projects across the South Eastern European region, a pattern of initiatives, driven by a vision of technology as a means of keeping up with advanced geographies, has been observed. Such projects are often shaped by large technology companies pushing the sale of overengineered, "Smart City" solutions, instead of serving the needs of the residents. Despite the brilliant marketing of such "Smart City" products and services, there has not been much evidence of their real-world impact and some have been abandoned due to the steep learning curve. Some other cities proceeded with the belief that simply adding on smart technologies such as smart meters, electric vehicles, a smart grid, or city control centre, will automatically solve their city challenges. They focused mainly on determining who to manage the project, where to deploy the smart technology and procurement process, instead of starting with:

a) clarity of purpose,
b) defining the particular problem, and
c) determining whether that particular technology is the optimal solution in the near and long term.

These examples highlight the ease by which investments could be lost, and that **simply procuring specific state-of-the-art technologies and implementing Smart City projects do not make a community resilient and sustainable. Basic infrastructure should be in place, com-**

bined with an integrated approach to planning and management. The current practice of developing Smart City targets separately, without integration with other objectives, achieves poor results.

The best outcomes emerge when Smart City vision is linked with an overarching strategy with clear goals based on the input of all relevant stakeholders. The effectiveness of the smart community i.e. one that is more resilient to physical, social and economic challenges, will largely depend on how resources are deployed, the method of solving problems, and the policies being implemented.

SMART CITY ACTIVITIES IN CROATIA

Significant differences exist between the built areas of Croatian cities and the rest of the administrative areas of the city. The administrative area usually encompasses a wider area than the built area, and may include a number of settlements of varying sizes. [14]

> 51.9 percent of the population live in built areas of 128 administrative cities, while 25 percent of the population live in the four largest cities – Zagreb, Split, Rijeka and Osijek. Croatia has a large number of small cities (with up to 10,000 inhabitants) and small number of medium-size cities (with 20-50,000 inhabitants). [18].

Recent analysis by the World Bank, based on data from the National Bureau of Statistics, indicates that the population of Croatia is likely to decline to around 3.5 million by 2050. Demographic trends show various rates of depopulation in all cities including the largest ones. However, there are slight increases in the number of inhabitants recorded by some suburban zones of the largest cities. Depopulation and population aging are increasingly critical issues for Croatia to manage across her cities, towns, and regions.

Despite the many constraints faced by the various local communities, especially the islands, Smart City initiatives in Croatia are predominantly local initiatives which happen to be driving the energy transition forward. However, there is no common national governance on Smart City development or a common deployment strategy. Eighty-four cities from Croatia are signatories in the Covenant of Mayors for Climate and Energy initiative, focused on local energy and climate action by reducing energy consumption, CO2 emissions and the impacts of climate change. Croatian cities also participate in international projects, programmes, initiatives, and networks dealing with low-energy districts and Smart Cities, such as C40, Eurocities, ICLEI, 100 Resilient Cities, Digital Cities Challenge, etc. This has helped them achieve some local objectives, without waiting for the sluggish, ineffectual and often ambiguous national programs. **Access to international platforms where knowledge, best practices, and lessons learnt are freely shared, enable local communities to circumvent inefficiencies on the national level.**

In light of these realities, some local govenments are implementing initiatives such as carbon-neutral islands by applying the Smart City concept in an effort to mitigate the effects of climate change in their communities. **However, as cities and islands in Croatia face diverse challenges, the adopted solutions need to be context specific, and not simply borrowed from another city or country.** While small towns and local island authorities face common challenges such as lack of administrative capacity and difficulties in adjusting to a fast-changing global economy, they each have their own specific contexts, traditional industries, and assets.

4

FINANCIAL OUTLOOK

A quick glance through the EGD or any Smart City project inevitably raises the question of how such projects would be financed. Smart infrastructure requires a large volume of investment. **How willing are the private sector and capital investors, often cited as key partners, to take on the associated risks posed by the low-carbon transition?** Is there an enabling environment for them to create sufficient surpluses for reinvestment? Public budgets tend to be under enormous pressure and stretched to capacity. Additionally, the value proposition of the project i.e. concrete evidence that it would deliver the promised resource efficiencies and cost savings, is not always clear, so private sector investors are often wary of committing resources. **An innovative energy financing mix which include new sources of finance would increase the implementation of sustainable energy projects and achieve the sustainability goals.** While there are many institutional investors active in the field of energy related financing, such as the European Bank for Reconstruction and Development (EBRD), The World Bank Group (WBG), and the Croatian Bank for Reconstruction and Development (HBOR), this section will focus on the private sector.

INVESTMENT OUTLOOK IN THE CEE REGION

Access to the right type of finance is essential for businesses as it enables them to innovate, improve efficiency, scale up, expand to new markets, and create jobs. However, there is an enduring problem of securing investment for high growth businesses in Croatia. The issue is especially pressing for innovative companies that are too young to have a credit history. Given that the solutions that are needed for the low-carbon transition are most likely to emerge from innovation, there is need to ensure that small and medium-sized enterprises (SMEs) have access to suitable finance.

Croatia lags regional peers in most relevant financial market and access to finance indicators due to specific difficulties such as an insufficiently developed capital market, among others. Total private equity and venture capital investment in the CEE region was €2.95 billion in 2019, which is its second highest annual result to date in value terms. 464 companies were funded of which 198 were Hungarian. [15] Estonia, Poland, Romania, Serbia, etc., all drew investments, leaving Croatia in the rear. When examining the specific amount of private equity investment in particular stages of business among peers in the CEE region, clear gaps emerge. The table below compares the investment gaps between Croatia and select countries. The amounts are depicted in million EUR.

Table 1
Comparison of Croatian investments with CEE countries by stage of business lifecycle (in million EUR)

Stage	2018					2019				
	Croatia	Serbia	Bulgaria	Romania	Hungary	Croatia	Serbia	Bulgaria	Romania	Hungary
Seed	0.3	0.3	3.9	0	23.5	0	0.8	2.8	0	36.3
Start-up	1.5	1.5	0.8	3.0	42.9	0.5	2.3	1.5	13.9	51.9
Later-stage venture	0	0	2.3	0	7.2	0.7	0.5	0	3.5	32.6
Total Venture	**1.8**	**3.9**	**7.0**	**3.0**	**73.6**	**1.2**	**3.6**	**4.3**	**17.4**	**120.8**
Growth	7.6	0	3.8	198	21.6	18.2	0	7.2	276	14.9
Rescue/ Turnaround	0	0	0	0	0	0	0	0	0	0.4
Replacement capital	0	0	6.2	0	0	0	0	0	0	0
Buyout	72.2	30	0	124.6	256	75	413	1.7	256.8	0.05
Total	**81.6**	**33.9**	**17.0**	**325.6**	**351.2**	**94.2**	**416.6**	**13.2**	**550.7**	**136.2**

Source: Invest Europe – 2019 central and Eastern Europe Private Equity Statistics [15]

DEVELOPING FAVOURABLE BUSINESS ECOSYSTEMS

In the "Global Competitiveness Report 2019", Croatia is ranked 63rd among 141 economies across the world. Despite moving five places higher due to a stable macro fiscal climate, **the competitiveness indicators that matter to business growth, that would enable the green transition, are still unfavourably ranked**. Croatia remains the worst in the efficiency of the legal system in dispute resolution (140th), government regulatory burden (139th), the efficiency of the legal system in challenging regulations (138th), the tendency towards entrepreneurial risks (137th), the government's focus on the future (137th), finding skilled labour (137th), employment and layoffs (136th), etc.

Deficiencies in management practices (financial management, business planning, etc.), value chain integration, product quality, lack of financial transparency related to enterprise revenues, pose constraints to increase in total factor productivity (TFP). **Companies need support in boosting their abilities to adopt or develop technologies, access and utilise market intelligence, and access to diverse, fit-to-purpose sources of finance.**

RISK

Financing complex, smart infrastructure takes many approaches. Numerous **financing tools tend to be deployed, depending on the nature of the project, its stakeholders, the size, its scale and the risk levels**. Risk estimation impacts the decision making of all investors, both public and private. Given the sustainability objectives, Smart City infrastructure projects tend to be very different from traditional ones. Those differences, which add new complexities to the risk profile, include:

a) high upfront costs,
b) new, easily misunderstood business models,
c) new forms of public-private partnerships,
d) new legal and regulatory frameworks e.g. rules guiding procurement, privacy, data security, data ownership, etc.
e) unpredictable risks e.g. gaps in skills, tender mis-specification, achievement of cost savings, etc.

The lack of clarity increases uncertainties, and the usual strategies of risk management such as risk transference via hedging and insurance, or diversification, fall short of covering the energy transition related risks.

5

MAIN IMPEDIMENTS TO SMART TRANSITION IN CROATIA

This section examines the key general/global obstructions to both the low-carbon transition and the Smart City concept. **The leaders of the EU acknowledge that a sustainable green transition is unlikely to be successful without the transformation of cities, by its Apollo 11 inspired mission to achieve 100 climate neutral cities by 2030.** With Covid-19 highlighting the need for improved digital infrastructure, and the opportunities offered in the Next Generation EU facility, Smart Cities are once again top of the most of the EU governments' agenda. However, the bedrock must have two aspects for progress to happen:

a) adequate connectivity infrastructure to handle the increased data, and
b) a truly collaborative ecosystem for the co-creation of innovative solutions

To align with the objective of achieving the EGD by implementing Smart City and smart islands concepts in Croatia, key issues that would need to be solved include:

1. POLICY GAPS

The Croatian policy environment as seen earlier, lacks key frameworks and Acts that would enable clear interpretation of policies related to low carbon transition. Energy efficiency and investment in renewable energy are hindered by administrative and legislative barriers. Additionally, local regulations and guidelines for implementing smart solutions for cities and islands are still lacking. This implies that all the current activities and investments face both legal risks, and the risk of developing point-solutions i.e. solving a particular problem without considering related issues.

2. GOVERNANCE FAILURES

Many city governments in Croatia have an articulated vision of implementing a digitally enabled energy transition. In an environment where technology is fast outpacing policymaking and goal-setting, however, **the leadership challenge is in determining how best to invest in the necessary intelligent infrastructure that would deliver long-term value. That challenge is further exacerbated by the lack of a finalised digital agenda on the national level, depicting clear governmental and institutional policies/initiatives, as well as the implementation.**

Local authorities face the challenge of introducing change without destroying legacy infrastructure. They need to avoid disruption for residents, businesses and public services. Furthermore, despite residents wanting their cities to be more modern, and for government to wisely manage resources, they also want to protect their privacy and to be protected from abuse. Meaning that implementing smart solutions, implies appropriate governance of data, especially as the issue of privacy and equity of data processing can only be addressed by means of policy which should define how the data is collected, who does the collecting and who benefits from its availability. Data collection and sharing must be standardised, so that all stakeholders can work together seamlessly. The capacities of public administrative staff would need to be strengthened to enable quality decision-making in alignment with the global goals and trends.

3. COORDINATION FAILURES

Coordination failures exist when parties: (a) are unaware of the possibility of collaboration, (b) fail to collaborate despite knowing that doing so would bring mutual benefits, and (c) make one-sided attempts and fail. Relevant information is neither readily accessible nor easily shared, resulting in lost opportunities for regional cooperation in Croatia, especially between ministries, local authorities, agencies and organisations working towards the same goals. **Effective coordination is further obstructed by disparate strategies, short-termism, silos, extreme fragmentation and tendency to boil the ocean.** This erodes confidence and inhibits the capacity for industry stakeholders to create and pursue new activities.

4. FINANCIAL GAPS

Globally, there is great interest in the private sector to scale up investments dedicated to low-carbon transition, climate change mitigation and adaptation. Financial constraint is a prevalent challenge in every spere in Croatia and the low-carbon transition as well as Smart City projects are no exception. **Existing infrastructure affecting activities such as smart water distribution and management, waste management, drainage, energy efficiency, etc., is outdated across Croatian cities. Real-time management or monitoring mechanisms are also lacking.** Coastal cities and communities that usually have the additional tourism related pressures on existing infrastructure which was not intended for such high usage. [16] Although infrastructure use is reduced in 2020 due to the effect of the Covid-19 pandemic on travel, the same issue is likely to re-emerge once the situation stabilises and unrestricted travel resumes. Furthermore, many local environments are unattractive to investors, due to a lack of physical as well as economic infrastructures.

5. TECHNOLOGY AND RESOURCE AVAILABILITY

Smart transition requires certain skills to be available alongside a minimum level of technological maturity. The largest urban areas also face the problems that are amplified in the smaller cities and island communities. Croatia lacks sufficient numbers and optimal conditions to attract/retain key talent such as engineers, programmers, strategists, designers, creatives, etc., who would design and implement such low-carbon focused plans and approaches. Additionally, **local authorities often lack the agile, open and inclusive forms of governance that would allow innovation to flourish**.

6

OPPORTUNITIES

Current level of development and the prevalence of innovative technologies offer opportunities for traction in developing smart solutions that would further the agenda of economy-wide decarbonisation. Of the 128 Croatian cities, more than 40 are developing the Smart City concept to enable better quality of life for residents. Some opportunities presented by smart transition include:

DEVELOPMENT OF NEW PRODUCTS AND SERVICES

The magnitude of the impacts of climate change presents a unique opportunity for innovation in technology projects, funding mechanisms, stakeholder interaction and knowledge sharing mechanisms. Further development in these areas will generate new business models, new ownership models, new products and services in high growth niches, which could positively impact the Croatian economy and the competitiveness of firms.

INCREASED ACCESS TO KEY SERVICES

Leveraging digital technologies to increase access to key services such as healthcare and education, could help tackle the issue of social inclusivity, while reducing travel related emissions. These tools thus directly contribute to social cohesion and eliminate spatial barriers, which is particularly important for people in rural areas and islands.

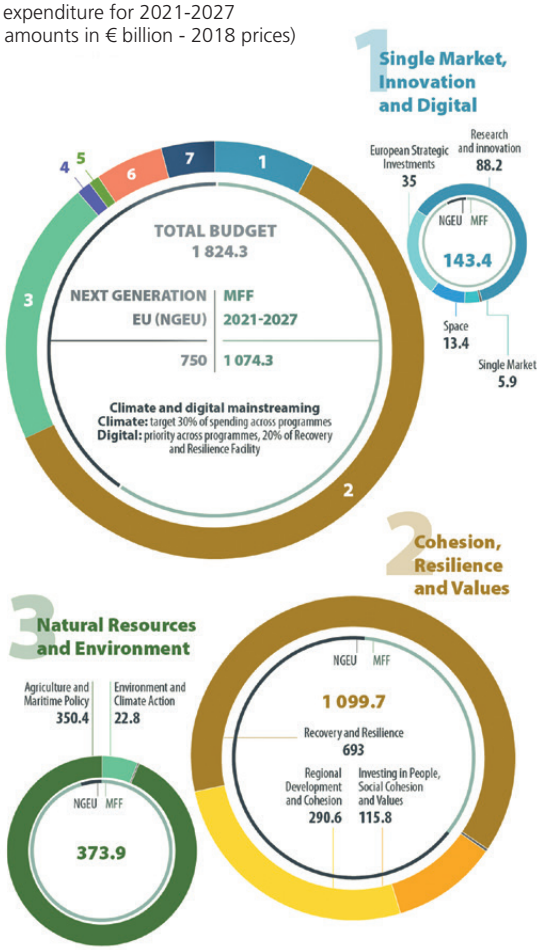
POTENTIAL FOR HIGHER RENEWABLE ENERGY PENETRATION

Island communities have the potential and local factor conditions to achieve energy independence by deploying renewable energy sources, while local companies have the opportunity to build capacities in developing integrated, community-wide solutions. Several islands are currently undergoing the transition to energy independence and developing integrated energy management systems.

EU PROGRAMS

The Multiannual financial framework 2021-2027 was adopted on 17th December by the European Council.[3] It presents new opportunities for Croatia as a member state to enable its local communities and businesses to tackle the economic and social impact of the COVID-19 pandemic, while also meeting the challenges of low-carbon and digital transition. Some program allocations can be seen in figure 4 below.[4]

Figure 4
EU expenditure for 2021-2027
(all amounts in € billion - 2018 prices)



3 https://www.consilium.europa.eu/en/press/press-releases/2020/12/17/multiannual-financial-framework-for-2021-2027-adopted/

4 https://www.consilium.europa.eu/en/infographics/mff2021-2027-ngeu-final/

7

RECOMMENDATIONS AND CONCLUSION

The COVID-19 It is clear that attaining climate neutrality requires strategies that link infrastructure development and technology innovation in the energy, building, transport and agriculture sectors. **Radical changes across the sectors will serve to reduce the carbon intensity of the energy supply and facilitate a reduction in energy-intensive behaviours.** By examining the ways people consume energy in buildings, transport and industry, a better understanding of the issues that need to be addressed in order to reduce emissions will emerge, along with some unique opportunities. **The imperative is for the energy transition or Smart City concept to be based on the principles of local resilience, effective and efficient utilisation of available resources and demonstration of value-for-money interventions.**

The obvious conclusion of this piece is that **the Smart City concept cannot be separated from the low-carbon transition which encompasses energy, mobility and climate change**. The main differentiator is in scope i.e. although the Smart City concept encompasses SDGs 1 to 16, it is locally driven and managed, while the low-carbon transition is orchestrated nationally/transnationally. This implies that one cannot happen without the other.

If this is the case, why are they in practice, currently on parallel tracks, instead of being integrated?

KEY RECOMMENDATIONS

Smart Cities/communities play the crucial role of implementor in the transition to low-carbon economy and in the energy transition. To achieve the objectives of low-carbon transition, urgent action in the following areas is advisable for all stakeholders:

I. CAPACITY BUILDING

Beyond the standard curricula, there is a lack of options for knowledge acquisition beyond the formal institutional framework such as universities. Institutional infrastructure that can facilitate skills development of the labour force, as well as targeted R&D&I for industrial upgrading should be developed and deployed. This would help tackle the issue of labour shortage and skills gap. Furthermore, careful development of public sector capacities such as the ability to execute basic project management tasks like procurement, asset management, coordination tasks, etc., could help integrate the cluster of institutions and public agencies. **Emphasis on capacity-building in local government and across the relevant professions is essential to shift Smart City plans and the use of novel technologies into people-centric opportunities** e.g. in infrastructure planning or smart regulation, rather than solely technology driven activities.

II. REDUCE FRAGMENTATION BY CONSOLIDATING AND INTEGRATING SYSTEMS AND SECTORS

Since energy production and consumption account for 75% of GHE in the EU, achieving the EGD rests heavily on the energy system. **Smart energy networks are about integrating renewable energy, digital infrastructure, energy storage, etc. Energy transition is not just about how individual types of infrastructure are powered, it requires large scale partnerships focused on consolidation and integration i.e. breaking silos.** By integrating sectors and reducing fragmentation, Croatia could use clean power supply to efficiently decarbonise transport, industry, and also meet heating/cooling needs. Policymakers should create a coherent, smart sector integration plan that would enable interaction with stakeholders, improve cooperation among sectors and revise energy governance.

III. ACTIVELY AVOID SHORT-TERMISM

Most local environments face issues with continuity of long-term strategic projects that span political administrations. Elected officials often enter office with a mandate to deliver on their promises and the need to leave their mark on a city/community often leads to new initiatives, even if that means neglecting what has previously been done. **To achieve long-term objective of carbon neutrality, continuity of policies and investment strategies**

across electoral cycles should be the norm. An institutional structure for low-carbon transition that is mandated to provide long-term and external advice would help hold leaders to account and achieve continuity.

IV. REDUCE INVESTMENT RISKS

There are many financial instruments and public funded incentives available to companies in the form of grants, subsidies, loans, etc. However, accessing these instruments can be challenging for firms, due to the convoluted process, long evaluation periods, heavy time investments for unpredictable outcomes, etc. Smaller firms lack sufficient human resources to simultaneously run daily business operations and go through the process of applying for public financial support measures. Commercial banks, on the other hand, are very willing to provide loans to any viable project, digital or otherwise, which places the risk of default on the entrepreneur. **To encourage investments in low-carbon transition, risk-sharing should be the standard. New asset classes such as green bonds that support the low-carbon agenda should be encouraged.** Additionally, an enabling environment for sustainable economic activities should be developed.

V. ENCOURAGE ACTIVE CITIZEN PARTICIPATION

The more complex a system, the more it relies on the corrective measures of a large input base. Thus, **Smart Cities can only truly be smart if a large number of people can participate in the goal-setting, data review and policymaking process**. In which case **the focus should be on encouraging "bottom-up" innovation and collaborative models**. Developing the notion of the 'smart citizen' as a co-creator of solutions such as energy communities, would create a rich intellectual tapestry in technology deployment and urban design, which could shift energy planning from a top-down (supply/cost-efficiency) perspective, to focus on demand and local resilience.

Final thoughts

The general understanding of governance needs an immediate upgrade. The government of Croatia should improve on: (i) clear communication and definition of national strategic interests, (ii) fast adoption of strategies, essential bylaws, country specific recommendations (CSRs) of the European Commission, etc., and (iii) establishing true partnerships with local communities, who should be included early in the process of projects affecting them. These few improvements would help align the objectives and hasten the transition process without leaving anyone behind.

Effective energy/low-carbon transition cannot happen without local level implementation, and fragmented Smart City projects across individual local communities cannot achieve the desired outcome, without coherence with higher level strategies.

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SMART CITIES AND ENERGY TRANSITION

Can one happen without the other?

Smart energy networks are about integrating renewable energy, digital infrastructure, energy storage, etc. Energy transition is not just about how individual types of infrastructure are powered, it requires large-scale partnerships focused on consolidation and integration i.e. breaking silos.

Digitalisation, decarbonisation and diversification are the three core areas that underpin the energy transition. Distributed energy resources (DER) from Renewables also characterise the energy transition, alongside the rise of new uses such as electric mobility and self-consumption of electricity. This transformation requires heavy investments in developing more flexible power grids and an IT infrastructure to manage the associated data in an increasingly complex energy system.

Simply procuring specific state-of-the-art technologies and implementing Smart City projects do not make a community resilient and sustainable. Basic infrastructure should be in place, combined with an integrated approach to planning and management. The practice of developing Smart City targets separately, as ICT projects, without integration with other objectives, will impede achievement of the overarching carbon neutrality goal.

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