

Smart-working and smart cities: sustainability, social dialogue, complexity

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Smart-working and smart cities across the EU - a comparison between five member States: France, Italy, Poland, Romania, Spain

1. Introduction

In this report we provide a comparative overview among the five analysed Countries: France, Italy, Poland, Romania and Spain with regard to the relationship between smart-working and smart cities, trying to incorporate lessons for industrial relations. The overall heterogeneities among countries, as well as the similarities in the joint development of smart-working and smart cities, will be highlighted through an analysis focused on the territorial dimension (e.g. urban vs. rural) exploiting the wealth of data collected and systemised. We further conduct our comparative analysis focusing the attention on the smart-working index, on the bottlenecks impeding the diffusion of smart working and on the environmental repercussion that smart-working may have, also in terms of quality of urban life. Finally, we discuss some emerging challenges for the industrial relations.

We conduct the comparison using the concept of smart-working as a wide hat under which including several forms of outside-the-office way of working - e.g. teleworking, remote work, agile working, as we did in other project deliverables. We refer the interested reader to the previous reports of the project.

In terms of smart city concept we acknowledge that in the last two decades, the concept of “smart city” has become more and more popular in scientific literature and international policies. To understand this concept it is important to recognize why cities are considered key elements for the future. Cities play a prime role in social and economic aspects worldwide, and have a huge impact on the environment (Mori and Christodoulou, 2012). According to the United Nations Population Fund, 2008 marked the year when more than 50 percent of all people, 3.3 billion, lived in urban areas, a figure expected to rise to 70 percent by 2050 (UN, 2008). In Europe, 75 percent of the population already lives in urban areas and the number is expected to reach 80 percent by 2020. The importance of urban areas as a global phenomenon is confirmed by the diffusion of megacities of more than 20 million people in Asia, Latin America, and Africa (UN, 2008). Before pandemic trouble the concept of the smart city was limited to the application of technologies to cities. The use of the term proliferated with no agreed upon definitions. Some authors argue that “as the term “smart city” gains wider and wider currency, there is still confusion about what a smart city is, especially since several similar terms are often used interchangeably” (Albino et al., 2015, p. 3). In addition, the Covid scenario changed the perspective and forced the cities to find ways to manage new challenges in many different sectors of the city life: urban transportation, energy and water supply, land use and waste, quality and intensity of urban services and industrial production, inequality, affordability and accessibility to services and ICT connection. Moreover, two other important aspects were recently debated because of the Covid-19 pandemic: educational and productive continuity, which are multiplying the reasons for a smart city strongly based on the digitization of many of the fundamental functions of civil life. We can conclude saying that a definition of smart city, among many others, we can use is: a city is smart “when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance” (Caragliu et al, 2011).

In what follows, we will first provide a summary of the national reports produced for each Country that examined in depth the data for each Country¹. Subsequently we provide the overall comparative analysis on the aforementioned issues.

¹ Available at <https://www.irsmart.eu/>

2 Smart-working and smart cities in the five selected countries – a summary

The present paragraph introduces the differences and similarities in the partners countries on the issues concerning the smart-working diffusion, the integration of the latter in the smart cities and the bottlenecks impeding the smart-working diffusion. In addition, we delve into the relationship between smart-working and the environment.

2.1 Countries summaries

France

The history of smart working in France goes back to the early 1990s, when government agencies started to support the development of teleworking and telecentres, although French citizens had not, at that time, fully embraced ICT yet. Well before the 2020 pandemic, various metropolitan areas such as Paris, Lyon or Nantes had started to support the development of their own regional network of coworking spaces, in a continued attempt to reap the benefits of smart working in terms of urban planning and economic development. France had to rise up to three main challenges in its switch to smart working practices: infrastructure and technology, eligibility of employees to telework and the cultural transformation of organisations.

Even if it's interesting to carry out a quantitative analysis that uses hypotheses for assessing a potential for smart working, the risk associated to it is not being able to capture the reality nor the full complexity and diversity of smart working phenomena. While telework can offer many benefits, such as reducing commuting, traffic congestion, and carbon emissions, it can also have negative effects, such as increasing social isolation, reducing urban vitality, exacerbating inequalities and increasing energy and resource consumption (i.e., rare-earth metals). These impacts are subject to significant uncertainty and depend on a range of factors, including the extent of remote working, the energy mix of the region, and the efficiency of the technology used for remote working. Smart cities, smart working and territorial resilience in France

The metropolitan concentration of the smart-working employees is extremely strong, with three major centers - Paris, Lille and Lyon. All these three metropolitan areas have their own logics of explanation - Paris as a global (Alpha) metropolis, Lille by its connection with the economically performant core of Europe and Lyon by its constant effort to be/become internationalized. In terms of urban attractiveness since the pandemic, cities smaller than Paris, be it Rennes, Nantes, Bordeaux, Toulouse, Montpellier, Marseille, Lyon, Strasbourg or Lille, have tended to attract more and more smart workers over the last years. While Paris still stays the unvanquished hub for smart working, its position in the national geography seems less crushingly dominant than before.

French territories have been following the same recovery trend since mid-2020, as smart working progressively seems to go back towards its pre-crisis level. Although it is reasonable to expect that the pandemic helped to make smart work more normal in many French territories, our data reminds us that a large part of French employees are not, and still won't be eligible for, smart work practices in the near future.

As for environmental effects of smart working, the relationship between the environmental indicators and the reduction of mobility seems clear in the main French cities, at least from the perspective of the indicator we analyzed – the concentration of NO₂. While the reduction of commutes allowed by smart working is not up for debate, more studies would be needed in order to assess the eventual carbon footprint of the switch to smart working - including the manufacturing of digital terminals, the increase of computing power and data storage needs, the sources of electricity used in technology-based activities at work, etc.

In terms of bottlenecks, as smart working generally requires a fixed broadband connection, we chose to use the FTTH (fiber to the home) coverage data made available in order to assess some of the territorial disparities.

As of 2022, FTTH connectivity data shows a triangle-shaped and very well-connected zone between Rennes, Dunkerque and Strasbourg, with Paris as a centre of gravity. On the other hand, three very poorly connected regions emerge: the infamous “diagonal of emptiness” that stretches from southwest to northeast, as well as Brittany and the Alps. However, no clear correlation seems to exist between FTTH coverage and smart working development. This may be explained by the fact that a still solid copper network (xDSL) combined with an excellent mobile broadband coverage provide sufficient connectivity to support the development of smart working practices.

The key findings for the French case are the following.

- At the national scale, France appears as quite a mature territory in terms of smart work, as telework has been steadily rising over the last twenty years. Some of the data suggests that France may have approached its full potential of smart working deployment during the pandemic, with a possible consequence: the marginal cost of policies aiming to support the development of smart work may be much higher today than in the 1990s and the 2000s.
- Smart work pervades all French territories, albeit not at the same scale since smart work still appears very polarized - mainly around the dominant hub of Paris and Île-de-France.
- At regional scale, metropolitan areas like Lyon or Toulouse seem to play the same role as Paris on national scale, in a transcalar (almost fractal) process of urban power spatial deployment.
- Environmental data from the pandemic suggests that, beyond the support of smart work, restriction of production levels in urban areas should be considered as an advantage for reducing territorial disparities, particularly in terms of environmental footprint.

Policy recommendations

- In order to increase the regional cohesion, policies need to focus on a more harmonized future repartition of the smart-working activities, encouraging the secondary cities to better attract them. The first lever policies can activate in France are teleworking arrangements in public administrations. Other telework-encouraging actions might include supporting investment for better amenities in secondary cities in order to make them more attractive to smart workers, such as public transports or medical care.
- On the private employers’ side, efforts to maximize smart work levels should focus on the cultural and managerial aspects of telework, which seems to be the main obstacle impeding the full realization of smart working potential.
- Last but not least, policies should focus on the environmental footprint of productive activities. The pandemic has both shown that 1) France is capable of reaching the objectives of the Paris Agreement and 2) smart work deployment comes at hidden costs (drastic increase in digital-related carbon footprint, growing gaps between smart workers and non-smart workers). National policies should focus on supporting a much stronger social dialogue about the transformations of work within the framework of climate-based economics, be it at the national or at the local level.

Italy

The Italian context has its own peculiarities concerning the diffusion of smart-working and the level of evolution and implementation of the smart city model differ significantly from each other. The implementation of smart working in Italy has been characterized by a profound North/South (digital) divide. The analysis showed a great concentration in the big metropolitan areas and mostly concentrated in the regional capitals through out all the peninsula. The big metropolitan areas of Rome, Naples, Turin, Milan stand out in the landscape of Italian cities. Beside, there is a pool of smaller but attractive metropolitan areas (Bologna, Verona, Florence) that are often pivotal nodes of highly urbanized regional systems. There are also medium-sized regional capitals where most of the tertiary and quaternary sector activities are concentrated. The data provided by Eurostat (Employment and social developments in Europe: 2020 review) confirms the low levels of smart-working diffusion in Italy, despite an intense growth of remote working in Europe, during the recent years. Looking at the Digital Economy and Society Index ([DESI](#)) rightly at the beginning of the pandemic (2019), we notice that Italy did not perform well when compared by EU average in terms of digital skills as well as in terms of internet usage.

In terms of data collection, the Italian statistical database does not provide a clear distinction between smart-working and traditional working arrangements. However, despite the difficulties in terms of data collection, it is possible to appreciate that Italy has still a lot of potential. The smart-working employees are obviously concentrated mainly in the top of the metropolitan hierarchy (Rome, Milan, Turin and Naples), but a very peculiar Italian urban system is showing a large horizontal Y, whose center is Milan, starting from Turin and reaching Venice and Rimini, crossing, along the first urban filament, the cities of Bergamo, Brescia, Verona, Vicenza, Padova and Mestre, and for the second urban filament, the cities of Lodi, Pavia and Cremona, in the Lombardy region, and Piacenza, Parma, Reggio Emilia, Modena, Bologna, Forlì, Cesena and Rimini. In the last 50 years, one of the largest metropolitan areas in Europe has developed around these two urban filaments or, using a different definition, a vast urbanized region in which between 20 and 25 million Italians live and work. Two other urban filaments - or two other urbanized regions - of smaller territorial and demographic size are extended from Milan to Genoa and from Florence to Lucca, Massa Carrara, Pisa and Livorno. Finally, the Italian case is also characterized by the two large metropolitan areas of Rome and Naples. These are two urban systems now extended over almost the entire plain and hill territory of the two regions that host them (Lazio and Campania).

Most of the accessibility is concentrated in the four big metropolitan areas of Rome, Naples, Turin, Milan and in the other regional capitals. However, especially in the South there are some areas with high accessibility but low levels of smart workers. A more granular analysis pointed out an even more heterogeneous landscape with LAUs that present a high level of activities related to smart working immediately next to other with no smart working.

When the potential bottlenecks to smart-working diffusions are considered we can mention the main two. Framing the bottlenecks impeding the development of smart working in Italy.

Internet speed: the analysis identified that there is a high distance between internet speed in metropolitan area and the other urban areas. This distance is higher in the North, but less pronounced in the South.

Internet use: the area in the center of the country (Tuscany, with the exception of Florence, Molise and Abruzzo) where internet use is below-average. Generally, Italy needs to catch up with the EU average in terms of internet usage.

Bridging smart cities with smart-working passes through relations between the main actors of the territory. For instance, the "Pact for Work and Climate in Emilia-Romagna" ("In Emilia-Romagna, we build the future together") signed in 2015 and then renewed in 2020 by the Region together with local authorities, trade unions, businesses, schools, universities, environmental associations, the Third sector, volunteers,

professions, Chambers of Commerce, and banks. In this pact, the smart city (mainly related to mobility) and smart working are explicitly identified as common objectives of the territorial community. This goes beyond mere redevelopment and planned expansion of suburbs to address the needs of the people living in these cities, regardless of their location (as stated in the recent Document on Urban Regeneration and living policies signed by Cgil, Cisl and Uil in 2021). However, not all of these needs can be met solely through the use of ICT. In this regard, the project "Nuove-Rigenerazioni" was born within the trade union context, in collaboration with Fillea-Cgil and Spi Cgil national unions, partnered with other research centers and civil society organizations with a view to providing a platform for discussion and debate to foster a culture of sustainability.

The main key findings emerged by the analysis of the Italian case, along the dimensions of smart cities, smart-working and environmental sustainability, can be summarized as follow.

- There are specific territories and metropolitan areas in Italy, that encompass about 35 million Italians, having a greater number of employees oriented to smart working activities and the greater potential accessibility to smart-working oriented employees at 2020, with respect to territories laying behind (e.g. scarcely populated and mountain territories).
- Workforce skills and population skills: the Italian society is still lacking of adequate skills to bear a shift to a digital society.
- Territorial disparities in terms of digital technology and territorial capital endowment that are exacerbating the north/south divide and the urban/rural divide.
- Environmental gains from smart-working and better urban life by reducing home-to-work (and vice versa) commuting and the consequent negative externalities

The main policy recommendation, that strictly follow the key findings are the following.

- The territorial disparities are due, also, to the different endowment in terms of technological infrastructure, which are essential to support smart-working (e.g. high-speed internet and reliable communication networks). The foreseen investments by the Agenda Digitale program have the aim, among others, to reduce disparities and create a digital society. To do that the policy interventions should be place based in order to answer to specific territorial needs. This way of proceeding should encourage the diffusion of smart-working in area with a current low potential, as well as increase the potential and the accessibility of relatively developed areas.
- Policies that promote skill development and training for remote work and in general to increase the population capacity to use eGovernment tools may be of help to build a capable workforce that is prepared for smart working and a society to support the development of smart cities and territories.
- Policies that address the disparities reduction are needed in Italy, to sustain a just transition both on the digital and on the environmental side.
- The last set of policies, which should be integrated with the previous ones, concerns the environmental sustainability dimension. An example of a framework for integrated policy interventions both on the labour and on the environment sides is the Emilia-Romagna region Pact for Work and Climate . Integrating the agenda of policy makers and regional/local stakeholders is crucial for the success of the Pact.

Finally, the role of industrial relations in this process of co-evolution of smart cities and smart-working, which are still two phenomenon and concepts that are too often separately analyzed, needs a change in perspective, in tools in competences and in the dialogue among the social actors. The challenges are multifaceted and involve deeply the society and its members. The complexity of the challenge facing policy makers is unquestionable, and for that reason social dialogue can be a valuable tool for reducing that complexity.

Poland

A review of the state of the broader public debate indicated the presence of the smart cities concept, among others, in strategic documents on the digitalisation of the country, as well as in the development strategies of large cities in Poland. There is also a certain body of academic literature on the subject. At the same time, strategic documents lack an in-depth analysis of the issue of smart cities – the term functions more as a slogan than a real subject of reflection and research. Poland is also characterised by a lack of association between smart cities and smart work - and this is already at the level of language, as the term “smart work” is not used in our country. Instead, it is most often referred to “remote work”, “working from home” or “telework”.

The pandemic has forced a surge in the use of remote working in Poland. Analyses by the Statistics Poland showed that it was most often performed in more urbanised regions (capital city, western voivodeships), and in service industries related to information processing, such as IT, finance, education and scientific and professional activities. Less remote working was used in the eastern regions – more rural and agricultural – and in sectors where the nature of the work performed precludes remote working (besides agriculture or manufacturing, these include, for example, accommodation services and healthcare).

Analyses conducted as part of the IRSmart project, based on the authors’ methodology, showed a similar spatial distribution of businesses offering workplaces with the possibility to perform tasks from home as above. Taking into account the possibility of a commute of 90 minutes or less, we see primarily Warsaw and its adjacent municipalities on the country's map as particularly ready for “smart working”, followed by other biggest Polish cities such as Wrocław, Kraków and the Gdańsk. What is surprising is the inferior potential for remote working in the case of the Upper Silesian conurbation and Łódź, probably due to the relatively outdated economic profile of these areas. They were overtaken by centres such as Olsztyn, Lublin and Rzeszów. Another unexpected finding is the significantly greater willingness to work remotely in the belt along the eastern border than in the western border. This is probably due to the presence of large and relatively modern cities (Białystok, Lublin, Rzeszów) in the east, while the role of such an agglomeration attracting remote workers on the western edge of the country is played only by Szczecin. On the map of the country, one can see in particular one extensive and coherent area of medium to high readiness for remote working, stretching across the southern regions from Wrocław, through Opole, Upper Silesia, Kraków to Rzeszów.

An interesting conclusions are provided by the analysis of workplace attendance thanks to Google data collected during the pandemic period (spring 2020 to autumn 2022). Initially, in March and April 2020, a very significant decrease in commuting, ranging from 40 to 50% for the largest Polish cities, was felt, followed by a gradual increase, halted during the second wave of COVID-19 (autumn-winter 2020/21), and showing a cyclical pattern due to holiday periods. In autumn 2022, the cities analysed most often still showed a decrease in workplace attendance compared to the comparison period in early 2020, but very slight – no more than 15%, usually below 10%. Importantly, the size of the city and the profile of its economy correlated with the degree and persistence of this decline. Among the largest cities, commuting decreased the most in Warsaw, Kraków and Wrocław, and the least in Bydgoszcz, Katowice and Łódź. A similar, though less pronounced, trend occurred in terms of the decrease in nitrogen dioxide air pollution in large cities during 2020. Two decreases can be discerned in the figures, triggered by the restrictions resulting from successive waves of disease. A stronger decline was marked in cities such as Warsaw, Wrocław and Krakow, while the graph is rather flat for Łódź and Katowice.

Data on the quality of Internet connections and frequency of Internet use were also analysed. The analysis indicated the average, in comparison to the European Union, speed of the Polish Internet. It is relatively high compared to neighbouring countries, but much lower than in Scandinavian countries. Territorial cohesion is not preserved – high quality Internet is available in large and medium-sized cities, while in peripheral areas

its speed is sometimes unsatisfactory. The situation is particularly unfavourable in parts of the north-eastern part of the country, but also – surprisingly – in the south-west (Lower Silesian Voivodeship), as well as in various regions in the centre of the country, such as the Kujawsko-Pomorskie Voivodeship or the agricultural areas in the north and south of the Masovian (capital) Voivodeship. The advanced use of the Internet – for which the popularity of e-banking was an indicator – despite a marked improvement during the pandemic period, is less widespread than in Western Europe, but performs better than in most regions in the countries of the south-eastern part of the continent.

In conclusion, the analyses conducted showed the trends that could be expected in terms of the use of smart working: urbanised areas and those with a modern economic structure have greater potential for it. Data from the pandemic period showed that these areas also experienced a greater decline in spatial mobility and air pollution. At the same time, Poland is still an inconsistent country in terms of willingness to perform remote work. The case of areas along the eastern border is particularly interesting here: on the one hand, the relative proximity to large and modern agglomerations creates potential, but on the other hand, the quality of Internet connections there may prove to be a bottleneck. Poles also still need to learn how to use digital technologies to be able to do smart work effectively.

Romania

The analysis of the results obtained within the 4th package of activities (WP4) of the IR-SMART project highlights the particular position of Romania, through the prism of the indicators collected and mobilized in the research process (indicators of territorial endowment at the level of IT&C, territorial diffusion potential for smart-working activities, mobility indicators and environmental impact). This particular situation represents a combination of elements that place Romania in an advantageous position in certain hierarchies, for example the average speed of the Internet at the local level, but it is a penalizing one for other levels of analysis - the stock of employees capable of performing smart-type activities working.

From a territorial perspective, the main conclusion that can be drawn from the research aligns with previous geographical and planning key findings, emphasizing the fact that Romania's territory tends to encompass an increasingly consistent set of local, county and regional discontinuities and disparities, with a harmful effect on the territorial cohesion. Thus, from the point of view of territorial endowments in terms of IT&C, a clear discrepancy can be observed between rural and urban spaces, especially in the proximity of cities with a functional metropolitan vocation – Bucharest, Cluj-Napoca, Iași, Timișoara or Brașov. On top of this discrepancy is superimposed the extremely intense opposition between the local territories capable of attracting smart-working workforce (IT, medicine, research, etc.) and those territories that are less advantaged in this remodeling of the workforce structure (the rural areas in difficulty, small mono-functional towns, towns specialized in classic industrial activities, etc.). This underlines the need to reflect on a set of policies and actions capable to frame and manage these disparities. It would be an illusion to believe that these territorial discontinuities will be eliminated by themselves (through the force of the markets and the interactions of economic actors) or that they can be controlled through direct actions (centralist interventions), actions that do not harm the competitiveness of the Romanian metropolitan areas. Most likely, the respective set of policies and decisions could become operational by encouraging the diffusion of smart-working activities towards the middle or lower urban levels and by developing IT&C corridors of national, regional and local caliber, corridors capable of correcting the existing deficiencies in equipment territorial.

The analysis of the effects induced by the diffusion of smart-working activities in Romania was carried out by integrating in the research process relevant indicators regarding the spatial mobility of the population and its effects on environmental indicators. The analyzed period was 2020-2022 and it was impossible to extend due to the absence of statistical information. The correlation between the reduction of spatial mobility and the beneficial effects on the quality of the urban environment is intuitive and obvious. Similar results were

observed in other case studies developed in the IR-SMART project – France, Italy, Spain or Poland. After a period of steep decline in the urban mobility, a decline induced by the measures against the COVID 19 pandemic, a systematic and constant recovery of the level of mobility is observed, with variations from one metropolitan area to another. However, it can also be observed that large cities with a solid specialization in smart-working activities (Cluj-Napoca, Timișoara or Iași) show a lower mobility recovery rate, compared to cities specialized in traditional activities (Craiova or Brașov , e.g). For the moment, the absence of statistical information makes us cautious in estimating what was the impact of reduced mobility on the environmental indicators, but it is extremely likely that the diffusion of smart-working type activities will positively influence the quality of the urban environment, by progressively reducing the values relevant indicators (CO₂, NO₂ or CO), especially if this diffusion becomes a sustained and a long-term practice.

Spain

The picture analysis of smart working in Spain indicates that long-standing institutional inadequacies thwart the potential of smart working and carry significant consequences. The first, and most obvious is the loss of development potential that has come to be associated with the availability of flexible regulatory and institutional frameworks that encourage mobility of physical and human resources, other than attraction of talent. The other consequence is that the above unfolds in a context that has long since suffered from territorial disparities that have accelerated since the COVID emergency. While there appears to be a healthy distribution of opportunities between the five major Spanish metropolitan areas, the gap has increased with respect to the rest of the country. These growing territorial gaps are a concern of both domestic and international policy makers as cumulative gaps in growth, development and prosperity exacerbate the decline in the availability of essential services such as education and health, thus ultimately threatening social cohesion. The COVID-19 recovery plan put in place by the government in synch with the European Union in 2021 has not mitigated population decline in peripheral areas, even in spite of significant targeted investments, for example the modernization of the telecommunication infrastructure to support the diffusion of digitalisation. This is probably an indication of the need to design policies that, besides driving infrastructural growth, aim more directly at reversing the consolidated vicious circle of decline.

From a policy perspective, two critical areas of interventions emerge from the analysis.

First, policies should promote skills development in synch with the recent legislation of remote and smart working. One is essential for the other. The 2021 law sets the course for an easier transition towards alternative forms of work arrangements but skill gaps and inadequate training have proven to be a significant hurdle throughout the pandemic. Active labour market policies and training policies, duly re-designed to boost effectiveness and efficiency, and suitably endowed, are a natural lever for ensuring the adaptability of the skill endowment in the face of fast changing circumstances. Spain has a large endowment of universities and vocational training centers that could add remote work skills to the basic curriculum for younger generations as well as promoting lifelong learning projects for older cohorts of workers in need of retraining. Such a goal calls for a concerted effort not only on the part of teaching organisations but also of regional development agencies and local councils for education.

Second, in a country with a high degree of administrative decentralization as Spain, it would be desirable for regional and local governments to coordinate their practices, sector by sector, onto a coherent regulatory framework. Long standing differences across regions in the bureaucratic protocols to i.e. undertake investment projects undermines development opportunities, especially for peripheral areas which are increasingly unable to attract resources. More than this, concerted national-local efforts are necessary to reduce growing socio-economic vulnerability. One interesting step in this direction is the recent Work-Life Balance Directive by the European Commission, a provision that seeks to redress the balance between family and career by setting minimum standards for leave entitlements and flexible work arrangements for parents

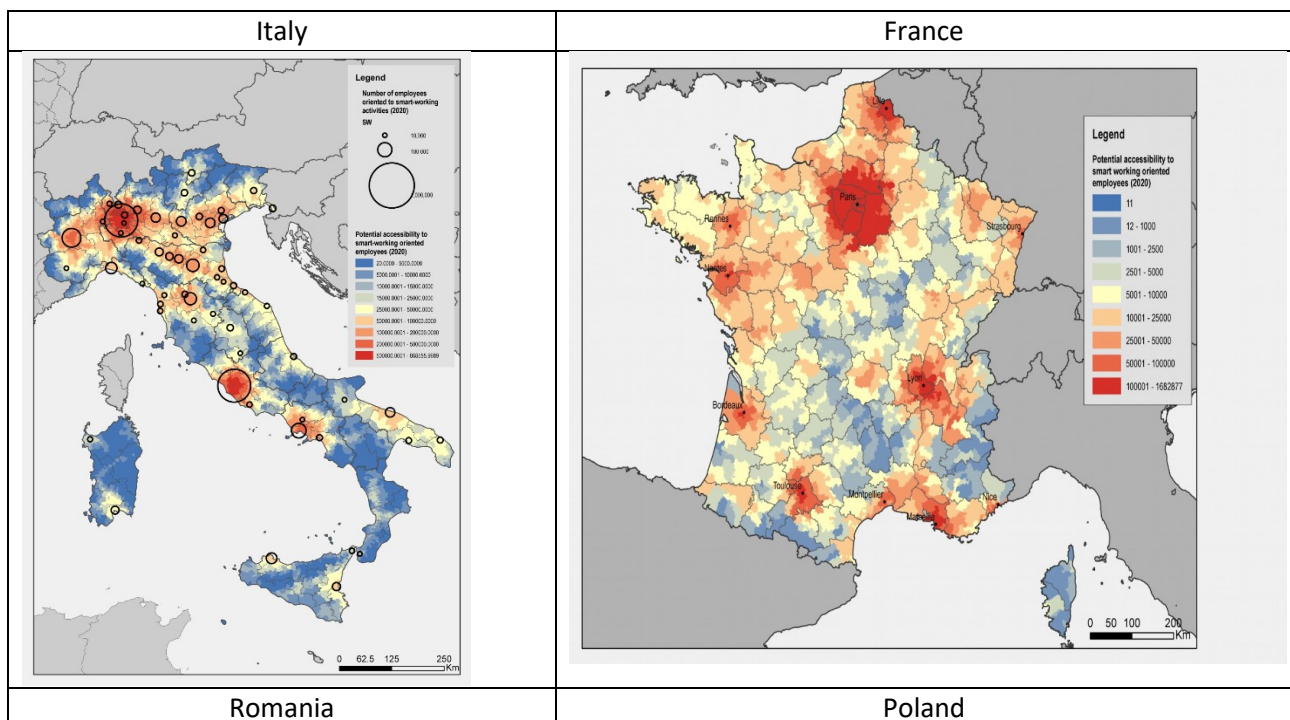
and personal care workers. All in all, promoting development and smart working requires broad coordination across interconnected regulatory domains such as training, employment, mobility and business.

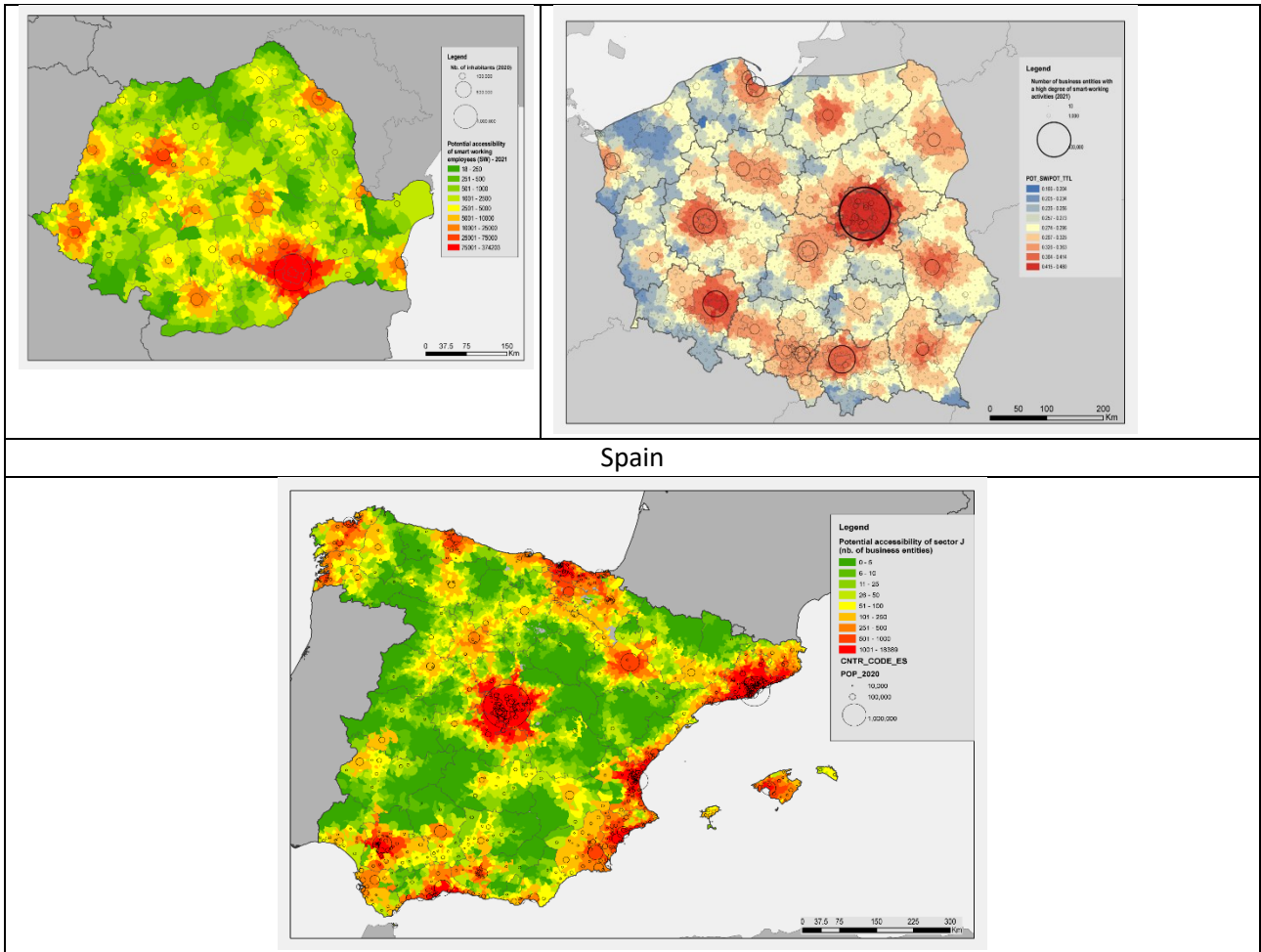
2.2 A comparative overview

Overall, what emerges from all the five countries is that the discourse around smart cities is still at its infancy. This might be mostly related to the lack of a proper definition framework. The lack of an operational definition of smart cities hinders possible policy applications. This makes also difficult to connect the concept of smart cities to other key concepts. Though, from the academic research smart cities could be a key enabler of more sustainable production and consumption patterns as well as more flexible working arrangements. This unclear definition of the concept does not allow further studies linking smart city to smart work and in turn further studies even at territorial level.

In the context of smart working, the COVID-19 pandemics has inevitably pushed those kind of arrangements in order to respond to the emergency. However, from the national reports it is possible to understand how the five countries subject of analysis were in a different state with respect to the adoption of smart working before the pandemics. In France, for instance, remote working arrangements were supported since the early 1990 and in 2017 25% of the employees were covered by some agreement on smart working. At the opposite, Spain before the pandemics showed a low incidence of Out Of Office (OOO) work before the pandemics with almost 76% of the employees that have never worked from remote before the pandemics. The percentage of employees that work from home in Poland is still the lowest in the EU even after the pandemics. In Romania and Italy the level of ICT skills of employees is lower and is mostly caused by a digital divide among different parts of the country. Pretty much all the five countries present to some degree a north-south divide mostly related to economic specialization and development. Figure 1 compares the smart working accessibility index (SW1) for the five countries. As mentioned, the territorial differences in smart working accessibility are related to infrastructural heterogeneity but also to the economic vocation. In most cases, smart working is mainly polarized to the main the capitals.

Figure 1 – Potential accessibility of employees active in smart-working oriented sectors normalized by the potential accessibility of the total amount of employees

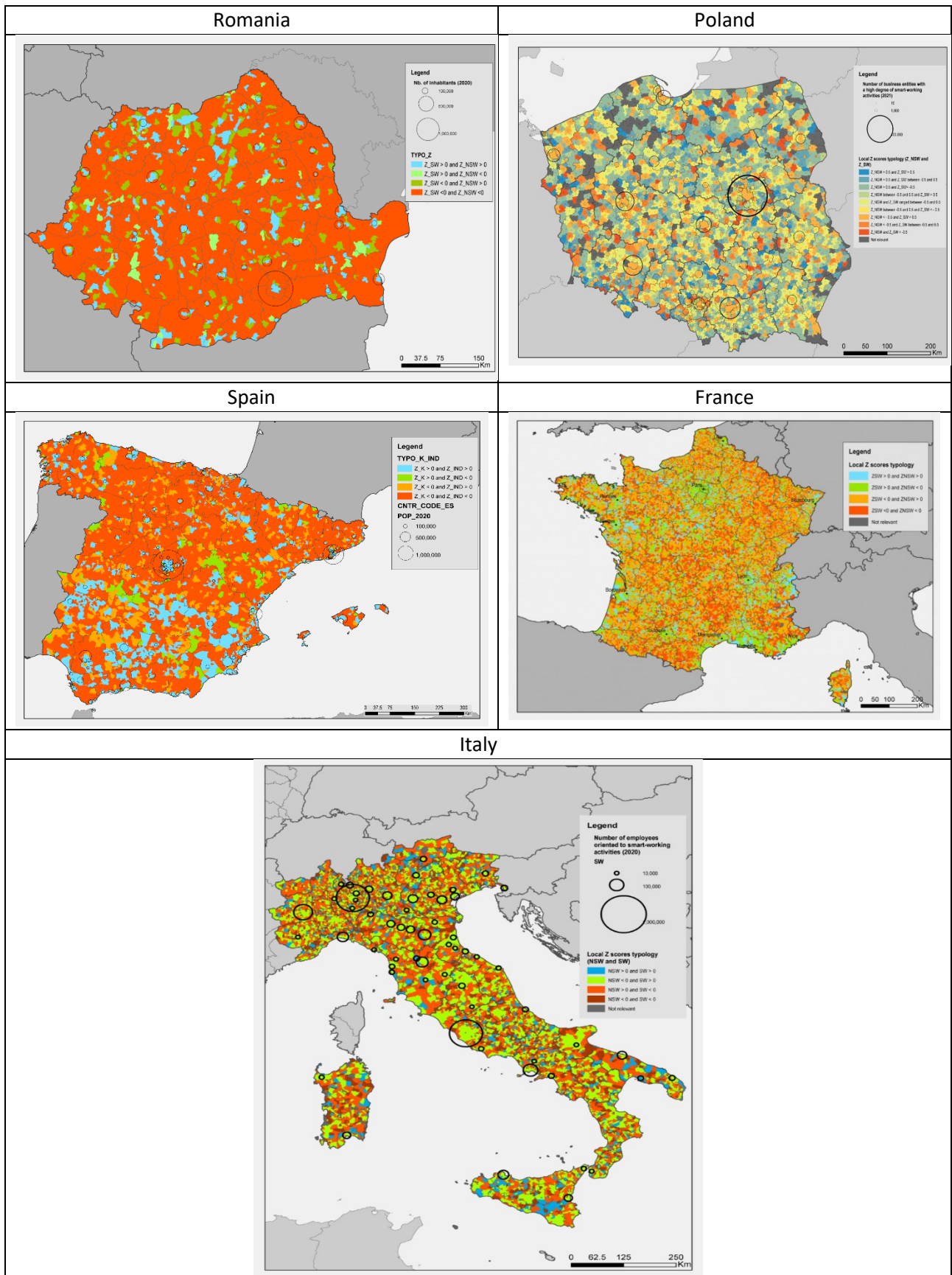




Spain

Comparing the five figures it is possible to assess that there are poles where smart working accessibility is higher. Those poles can be identified in the capitals of each country (Rome, Madrid, Paris, Bucharest, Warsaw), but also to other big cities that for economic vocation is more oriented to smart working (Barcelona, Costanta, Lyon, Milan, Wroclaw). There is a further layer of heterogeneity common to the five countries related to the difference from urban and rural areas. Figure 2 shows the difference in terms of smart working and non-smart working activities. Those territorial differences can be associated to rural and urban areas.

Figure 2 - A qualitative assessment of the smart-working employees vs. traditional employees, using the local Z scores



Those figures show that the LAU where workers employed in non-smart working activities are prevalent are located in rural areas. At the opposite, poles with high accessibility to smart working are mostly urban areas and more concentrated in the cities mentioned above.

In terms of internet access to population, there is also a difference among those countries that provide a higher access to broadband (France). In the other countries such as Romania and Spain, internet speed follows the north-south divide. Italy shows the lowest level of internet speed in the Center except for the hub of Rome. Despite this trend in internet speed internet usage still seems to be polarized. In the case of France and Poland, internet usage is higher in some areas (Île-de-France, Masovia, Lower Silesia, Marseille). At the opposite, in Spain 90% of the citizens all over the country are using the internet.

For mobility and environmental output all the countries show the same pattern. Mobility was lower in the months of the full lockdown in all the five countries. What is interesting is that in all of the countries the majority of the workforce came back to offices when allowed. This influenced the pattern of Greenhouse Gas emissions, in this case NO₂, that started to increase again from April 2020. Some heterogeneity can be found related to those cities with more touristic vocation (Costanza in Romania) or with more industrial vocation (Katowice, Krakow).

In this context, where structural issues undermine the diffusion and adoption of smart working the role of industrial relations might be pivotal. Industrial relations should be understood in a broader sense considering agreements among industries and relevant stakeholders to set out common territorial objectives. In France, by 2005 cross-sectorial agreements were arranged to favor more flexible working conditions including, remote and out of office work. In Italy, an example is the Pact for Work and Climate in Emilia-Romagna ("In Emilia-Romagna, we build the future together") signed in 2015 and then renewed in 2020 by the Region together with local authorities, trade unions, businesses, schools, universities, environmental associations, the Third sector, volunteers, professions, Chambers of Commerce, and banks. In this pact, the smart city (mainly related to mobility) and smart working are explicitly identified as common objectives of the territorial community. Smart cities are connected to the improvement in living conditions and social inclusion. This goes beyond mere redevelopment and planned expansion of suburbs to address the needs of the people living in these cities, regardless of their location (as stated in the recent [Document on Urban Regeneration and living policies](#)² signed by Cgil, Cisl and Uil in 2021). Local initiatives such as The Romanian Association for Smart Cities might favor the dialogue among public and private stakeholders to bridge smart cities with key concepts such as smart working. Cities like Rzeszów in Poland that are already advanced might provide a pivotal instance influencing other communities in the countries.

The potential challenges in front of industrial relations are discussed later on in the report.

2.3 Bottlenecks to smart-working diffusion; the mobility issue and the environment

Among the multiple issues emerged from the analysis of the relationship between smart-working and smart cities the bottlenecks to the smart-working diffusion and the connections between mobility and the environment are the most prominent.

As far as the factors hampering the diffusion of smart-working are concerned, one of the bottlenecks is given by the heterogeneous diffusion of broadband and fast internet speed in the five countries. While the cities enjoy a sort of accumulation path towards a more and more digital integration and fast connection with the diffusion of smart-working and co-working spaces, the non-urban territories experience relevant obstacles in developing as smart territories. In these contexts, more than in urban context the dialogue among different

² <https://binaries.cgil.it/pdf/2021/08/06/081518733-8d992676-5927-43ba-a53c-cbe0cb1c1b53.pdf>

stakeholders may be helpful in overcoming the obstacles and setting the roots for a digital development, with the aim of attracting smart workers. Such a dualism, urban vs. non-urban areas, is present in all the countries analysed, but with significant nuances.

A further bottleneck that is common in the five countries, but mainly experienced in Poland, Romania, Italy and Spain, is the issue of digital competences in the population. When the digital skills lack, it might be difficult to both foster smart-working and integrate it in smart cities and territory. The aggregated data by country may however fail to capture demographic details. As an example, in a country like Italy, where the aged population is steadily increasing in the last decades, the scores of the DESI indicators below the EU average in the population digital skills may be due to the high share of elderly people in the population. The digital competencies of the labour force may be well suited to answer the current needs of the digital transition, but a fine grained analysis is needed.

In terms of mobility, a common trend emerges from all the countries studied: during the pandemic the cities analysed experienced a sharp reduction in air pollutants (NO₂ was analysed) in concomitance with the periods of hardest pandemic containment measures, such as lock-downs. This does not come as unexpected, but it evidently show how the diffusion of remote working may produce positive environmental externalities and, especially in densely populated urban areas, an amelioration of the urban quality life (e.g. reducing road congestion during the rush hours).

As for the environmental aspects, which are related to the workers mobility, the analysis from the five countries highlighted the need for more research on the matter. Smart working requires the increase in ICT based technologies in terms of computer power and storage capacity. This in turn requires more electricity to source those technologies. If smart working might reduce commuting the switch to such kind of working arrangements might increase energy demand. Further research in the topic should consider the so-called system dynamics to investigate the real contribution of smart working in lowering the environmental footprint. This might also orient policy actions towards a more sustainable approach to smart working.

3. The role of industrial relations and the challenges ahead

When we turn to the relationship between industrial relations and smart working within the context of smart cities, it is evident how it is intricated.

Initially, this relationship faced a climate of mistrust, but it has evolved, especially during emergency management situations, prompting a need for prospective transformations in industrial relations when dealing with the concept of smart cities.

The focal point of industrial relations is no longer limited to just the company; instead, it expands to encompass the entire territory within which smart cities are embedded. With the acceleration of smart working, new challenges arise, revealing material and immaterial differences that must be reconciled through effective bargaining at the territorial level. This is essential to govern the various challenges that smart cities present, such as planning, sustainability, transparency, knowledge, quality of life, and work.

Several key challenges emerge regarding smart city strategies and their implications for industrial relations.

Coordinating with Multiple Stakeholders: Smart cities necessitate collaboration among diverse stakeholders, including businesses, governments, citizens, and technological partners. Industrial relations must navigate these complex relationships to ensure effective cooperation and communication. However, accessibility to the digital potential of smart societies (smart working and smart cities) experiences territorial and sectoral polarization. A system of collective bargaining primarily focused on national sectoral and company levels can

exacerbate differences instead of reducing them. Consideration of territorial perspectives and confederal convergence is vital for successful integration.

Addressing Sustainability and Environmental Impact: Smart cities strive for sustainable development and reduced environmental footprints. Industrial relations should incorporate green practices and promote environmentally responsible approaches within industries. Managing mobility, a significant aspect of smart cities and smart working, becomes a public issue that requires regulation from public entities, aligned with environmental sustainability strategies.

Emphasizing Transparent Governance: In smart cities, transparent decision-making and governance play a crucial role. Industrial relations need to advocate for transparent and participatory processes that involve workers in shaping the future of their industries and communities. Digital networks should become works of public interest, and the data flowing through them should become a common good, accessible to all citizens. This promotes transparency and facilitates the exchange of information to reduce reluctance in sharing personal data.

Promoting Inclusivity and Equity: Smart city initiatives should be inclusive, ensuring that all members of the workforce can participate and benefit. Industrial relations must advocate for fair and equitable access to opportunities and resources, guaranteeing better working conditions for all. Addressing the pressures of large digital platforms on working conditions and job quality is crucial, and collaborative agreements such as the “Charter of Fundamental Rights of Digital Workers in the Urban Context” can play a role in ensuring secure and dignified employment, even in the digital work sphere.

Fostering Lifelong Learning: The rapid pace of technological advancements requires a continuous learning approach. Industrial relations should collaborate with employers to promote upskilling and reskilling opportunities for workers to adapt to changing job requirements. Italy faces challenges in this regard, as digital skills readiness falls behind the EU average, emphasizing the need for substantial improvements to meet the Digital Decade targets.

We highlight the importance of a proactive approach to industrial relations in the context of smart cities, focusing on collaboration, sustainability, transparency, inclusivity, and continuous learning to ensure the well-being of the workforce and the effective integration of smart technologies in urban environments.

4. Concluding remarks

The work conducted on the issue of integration between smart-working and smart cities has firstly shown the lack of a common grounded operational definition of smart cities. This poses some difficulties in deepening the analysis of the smart-working and smart cities integration using a sound analytical framework.

Despite such a difficult the national case studies were able to conduce comparable analysis given the common types of data used. Indeed, although they were collected from different sources, their systematisation and the creation of common indexes has allowed the partners to conduct both meaningful analysis and comparable ones.

The following are the main remarks brought to us by the analysis.

- Smart-working arrangements have been critical and effective to respond to the restrictions during the COVID-19 pandemic. In the aftermath of the emergency the attention at policy level on the remote working seems to be lowered. This might also be due by the reaction to the remote working diffusion with an increasing return to in office work recently experienced at a global level.
- Except for France, the other countries were unprepared to switch to smart working during the pandemics. However, they showed a capacity to quickly respond to the emergency and catch up.

- Territorial differences (e.g., north/south, urban/rural), with specific countries heterogeneities, are also present when dealing with smart-working and smart cities. In some countries, along with the urban vs. rural disparities emerged, we assist to further level of disparities, that tend to qualify the digital divide at regional level (e.g. Italian North-South divide).
- Despite the great potentialities in each of the five countries, smart-working is not exploited in some areas. There seem to be a great polarization, namely areas with higher accessibility to smart working and areas where there is none. These circumstances call for a pledge in the smart communities projects, which may also born and prosper in areas where the accessibility to smart-working or the potentialities are currently low. The social dialogue might play a crucial role to shape the contours of these smart communities (e.g. the experience of the South-working movement in Italy is an example of this potential processes involving territories which are far from urban and industrialised context)
- Within the framework of analysis conducted in the report it is interesting to pint out the challenges ahead for the industrial relations. First of all there is a need to shift the industrial relations boundaries from the company to the territorial level, increasing the degree of complexity, because of the presence of different social actors. This, in turn, implies to cope with the challenges listed in the report and going from the coordination of multiple stakeholders to the fostering of inclusivity and equity and lifelong learning.

All in all the analysis here produced points out that in order to conduct a research that integrates smart-working and smart cities a systemic approach is needed, considering smart-working and smart cities as elements, which mutually feed each other, of a wider ecosystem. This, in turn, increases the complexity of the environment in which the industrial relations actors operate, calling them to cope with new and complex challenges.

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