

## WP4 National report

### Smart working and Smart Cities: a territorial perspective in France

June 2023



Co-funded by the  
European Union

## 1. Introduction

### 1.1 – National particularities

The data provided by Eurostat (Employment and social developments in Europe: 2020 review) confirms that smart working practices are widespread in France, mainly due to a clear and robust legal framework at the national level. 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<sup>1</sup>, although French citizens had not, at that time, fully embraced ICT yet<sup>2</sup>. By 2005, a cross sectoral collective agreement on teleworking<sup>3</sup> was signed by the social partners at national level, and the year 2012 marked a turning point as the French Parliament voted two laws on telework - one for the public sector and another for the private one. This legal framework broadly reproduced the 2005 agreement, and might well have played an essential role in reassuring employers and organisations. By 2017, 25% of employees were covered by a collective agreement at company level (DARES, 2019). 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. At the peak of the COVID crisis, as much as 41% of French employees were teleworking<sup>4</sup>.

### 1.2 – Challenges of the switch to smart working practices

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.

*Infrastructure and technology:* in matters of smart working, France benefited from a few advantages: overall, fixed broadband network coverage approaches 100% (although mobile broadband coverage is much less widespread), and there has been a national policy framework for supporting the development of remote work since 2012. However, as the pandemic showed, not all workers have access to reliable and fast internet, secure and ergonomic workstations, or adequate software and hardware. This can lead to disparities in productivity, creativity, and well-being, as well as to security and privacy risks for the company and the employee.

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<sup>1</sup> <https://theses.hal.science/tel-00363936/document>

<sup>2</sup> <http://www.fim.uni-linz.ac.at/research/telework/tw99.pdf>

<sup>3</sup> [https://zevillage.net/wp-content/uploads/2005/07/ANI\\_Teletravail\\_19072005.pdf](https://zevillage.net/wp-content/uploads/2005/07/ANI_Teletravail_19072005.pdf)

<sup>4</sup> <https://newsroom.malakoffhumanis.com/download-pdf/62164467b96de86bf7147a2e>

*Eligibility of Employees for Telework:* One of the first issues that emerged during the pandemic was the selection of employees allowed to telework. Many workers who had never teleworked before were suddenly asked to do so, which raised questions about the criteria for eligibility. Some companies had clear policies and guidelines for telework, while others had to improvise and adapt on the fly. The result was a mixed experience for employees, with some enjoying the flexibility and autonomy of telework, while others struggled with the lack of social interaction and the blurring of work-life boundaries. To address this issue, companies need to develop clear and fair criteria for telework eligibility, based on the nature of the job, the skills and preferences of the employee, and the needs of the team and the organization. This requires a careful analysis of the tasks and activities that can be performed remotely, as well as the risks and benefits of telework for different groups of employees.

*Management and Leadership for Telework:* A third challenge of telework is the management and leadership required to ensure its effectiveness and sustainability. As the pandemic highlighted, not all managers and leaders are prepared or trained to manage remote teams, communicate effectively, and foster a culture of trust and collaboration. This can lead to micromanagement, burnout, and disengagement, as well as to conflicts and misunderstandings.

### 1.3 – Limitations of the study

Limitations of this study include the fact that it is based on a quantitative analysis that uses hypotheses for assessing a potential for smart working, which may not capture the reality nor the full complexity and diversity of smart working phenomena. While the sources used in this study are reliable and up-to-date, they may not reflect the latest developments and trends in telework, especially in specific industries and regions.

Another limitation of this study is that it might overlook the broader social, economic, and environmental implications of smart working. 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.

## **2. Smart cities, smart working and territorial resilience in France**

### 2.1 Theoretical approach

The concept of smart cities has been gaining momentum in recent years, with the aim of improving the quality of life of citizens through the use of digital technologies. Smart working, on the other hand, is a less successful concept that refers to the ability of employees to work from anywhere, anytime, thanks to digital technologies. The literature on smart cities and smart working is vast and varied. Some studies have suggested that smart cities can provide the necessary infrastructure and services to support smart

working, while others have argued that smart working can contribute to the development of smart cities. For instance, Vallicelli (2018) argued that smart cities could provide the necessary infrastructure and services to support smart working, such as high-speed internet, coworking spaces, and flexible transportation options.

On the other hand, some studies have suggested that smart working can contribute to the development of smart cities. For instance, Pratt<sup>5</sup> argued that smart working could reduce traffic congestion and air pollution, which are major challenges for many cities. Similarly, Kourtiti et al. (2021) suggested that smart working could contribute to the development of smart regions, by enabling workers to live and work in different areas, and by reducing the need for commuting.

However, there are also studies that have highlighted the challenges and limitations of smart cities and smart working. For instance, Katrini (2018) argued that smart cities could exacerbate social inequalities, by excluding certain groups of people from the benefits of digital technologies. Similarly, Vallicelli (2018) suggested that smart working could lead to social isolation and a lack of work-life balance, which can have negative impacts on workers' health and well-being. Finally, one of the main environmental concerns associated with smart cities is the increase in energy consumption<sup>6</sup>. The use of sensors, data centers, and other technological infrastructure requires a significant amount of energy, which can lead to increased greenhouse gas emissions.

## 2.2 Smart working potential at national level

### 2.2.1 – Potential accessibility to the stock of smart working employees or business entities

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<sup>5</sup> Pratt, J. H. Teleworkers, Trips, and Telecommunications: Technology Drives Telework—but Does It Reduce Trips? *Transportation Research Record: Journal of the Transportation Research Board*, 2002. 1817: 58–66.

<sup>6</sup> OBRINGER, Renee et NATEGHI, Roshanak. What makes a city 'smart' in the Anthropocene? A critical review of smart cities under climate change. *Sustainable Cities and Society*, 2021, vol. 75, p. 103278.

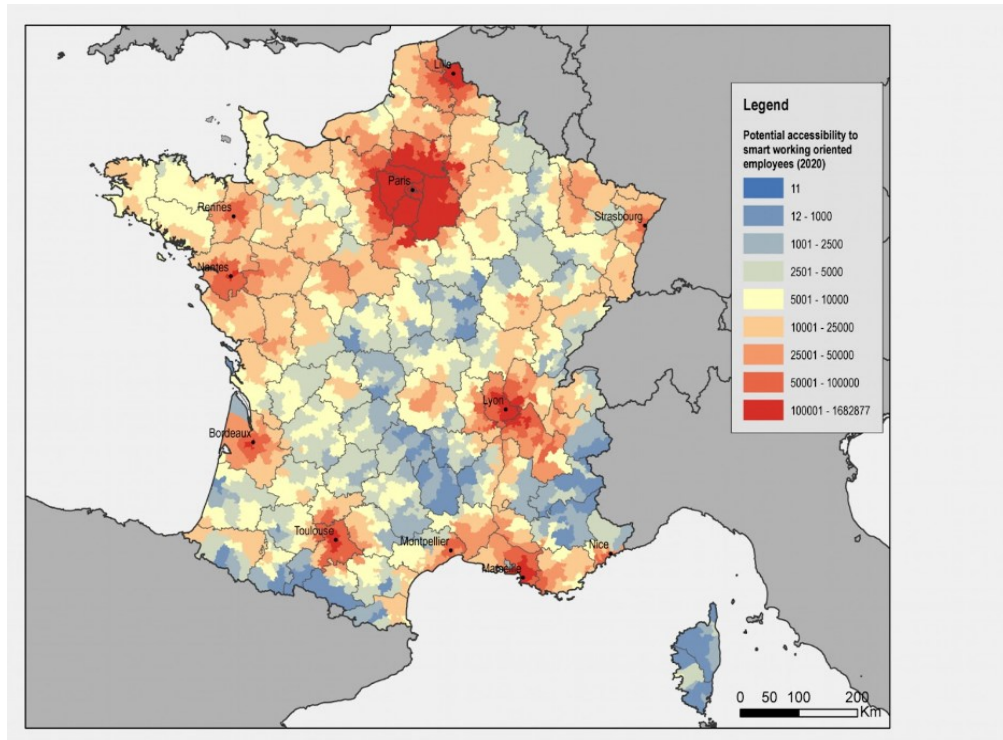


Fig. 1 SW Index 1 – SPATIAL DISTRIBUTION OF THE POTENTIAL ACCESSIBILITY TO SMART-WORKING EMPLOYEES IN FRANCE (2020) /DRAFT MAP. The potential accessibility of smart-working employees in 90 minutes.

### ***Key findings***

1. 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.
2. A secondary belt of metropolitan areas creates a peripheral spatial structure, defined by an intense orientation to smart-working. It contains Strasbourg, Marseille, Toulouse, Bordeaux, Nantes and Rennes. From Nice to Montpellier, these concentrations create a contiguous area.
3. The cities with less important territorial functions (Tours, Dijon, Clermont-Ferrand, Rouen, Metz or Nancy) generate discontinuities on the map, showing that the diffusion of the smart-working activities in the national space is not restricted only to the metropolitan areas. However, the cartographic footprint of these cities is largely underbalanced, compared to the upper part of the French urban hierarchy.
4. The distribution of the French cantons that have a low potential accessibility to smart-working employees presents two spatial patterns: one related to the areas with geographical specificities (mountain zones mainly), the second associated to the limit between the national areas of polarization for Paris and Lyon.

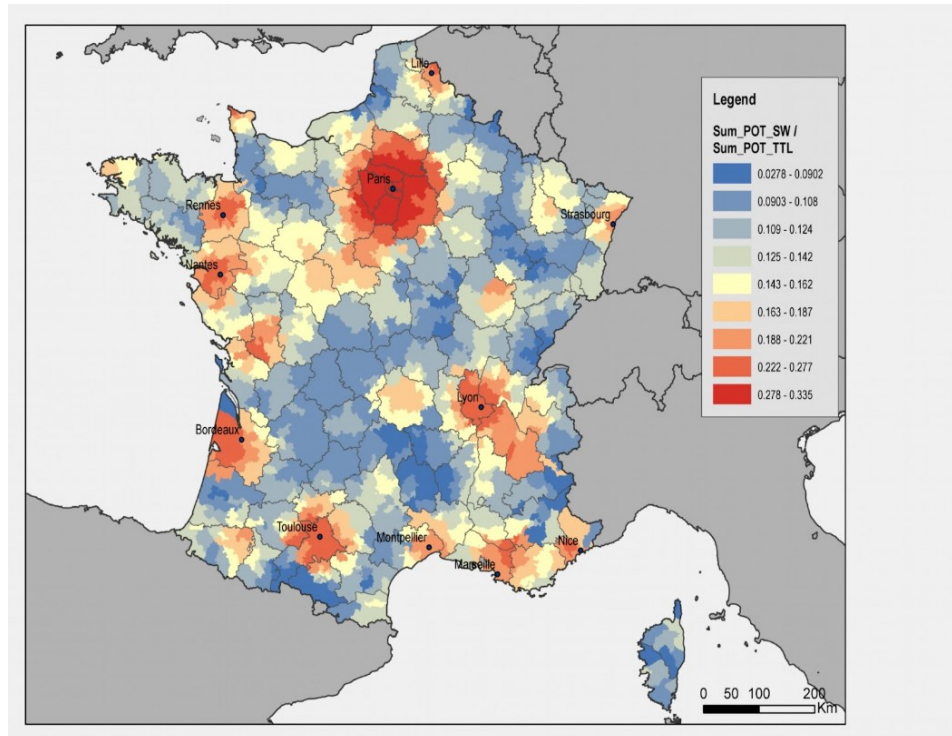


Fig. 2 SW Index 1 – POTENTIAL ACCESSIBILITY OF EMPLOYEES ACTIVE IN SMART-WORKING ORIENTED SECTORS NORMALIZED BY THE POTENTIAL ACCESSIBILITY OF THE TOTAL AMOUNT OF EMPLOYEES. The potential accessibility of smart-working employees in 90 minutes.

This maps might well depict what has been happening since the pandemic in terms of urban attractiveness, as 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 in the previous map.

The small potential of Corsica can be explained by two factors : a mountainous topography that impedes mobility, and an economy mainly based on tourism, a poorly smart work-oriented sector.

### 2.2.2 – A local index of spatial association between smart-working and other economic activities.

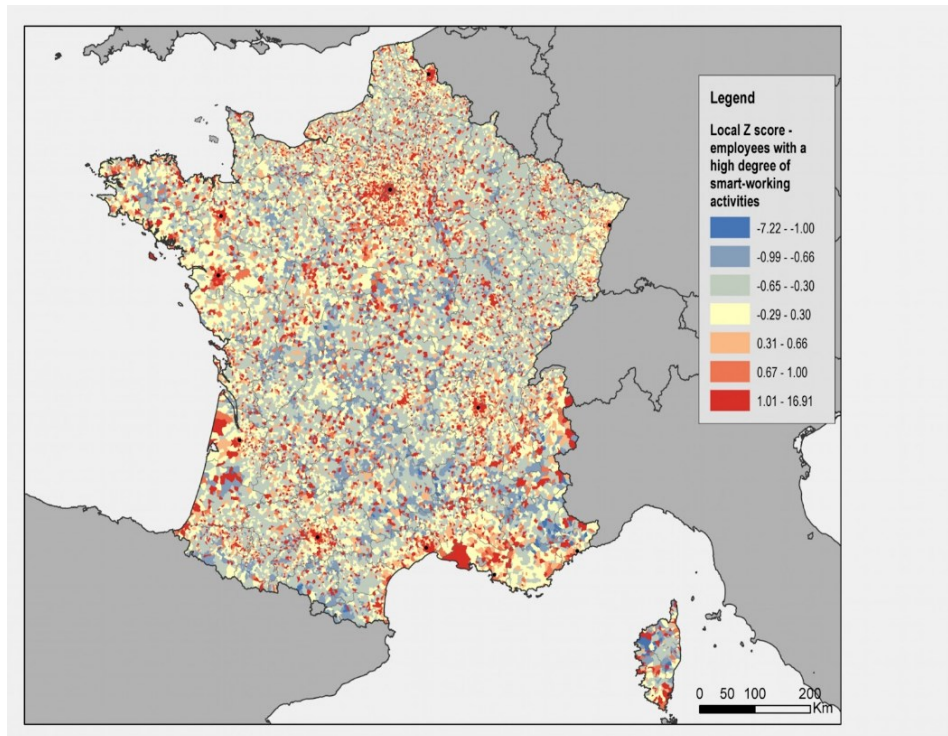


Fig. 3 – identifying local concentrations of smart-working employees using an alternative method – the local Z scores.

The SW Index 2 shows that the remarkable positive values (trends of intense concentration) can be found all over the French territory, and not just in the aforementioned cities. There are some noticeable local gaps (high positive + high negative):

- Mountainous regions such as the Pyreneas, the Alps, the Massif Central and the Vosges
- The Landes region (pine-covered moors)
- Parts of Bourgogne-Franche Comté and Occitanie

This distribution of the SW index indicates that there is still room for improvement in terms of harnessing the potential of smart work for developing peripheral areas. While some of this improvement might come from real-estate-based approaches such as “corpworking spaces” (see box 1 below), unions and public administrations supporting the development of smart work should keep in mind that French employees massively chose their own home over a shared workspace (including coworking spaces) when given the choice<sup>7</sup>.

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<sup>7</sup> According to Neo-Nomade / Worklib, a France-based digital platform for smart workers looking for “offices on demand”, 85 to 90% of employees prefer working from home.



### Box 1 - “corpworking” spaces in Occitanie : a brief case study

Action Logement Occitanie is a joint management company working in the field of social housing. Since 2016, unions have been working on a project aiming to reduce commuting distances in the region by providing company-owned, shared working spaces in the peripheral area of Toulouse. Various local actors have been mobilized for this project: the Regional Council of Occitanie, the national agency for the ecological transition (ADEME), other local administrations and companies.

To this day, two “corpworking” centres, partially opened to external workers, have opened.

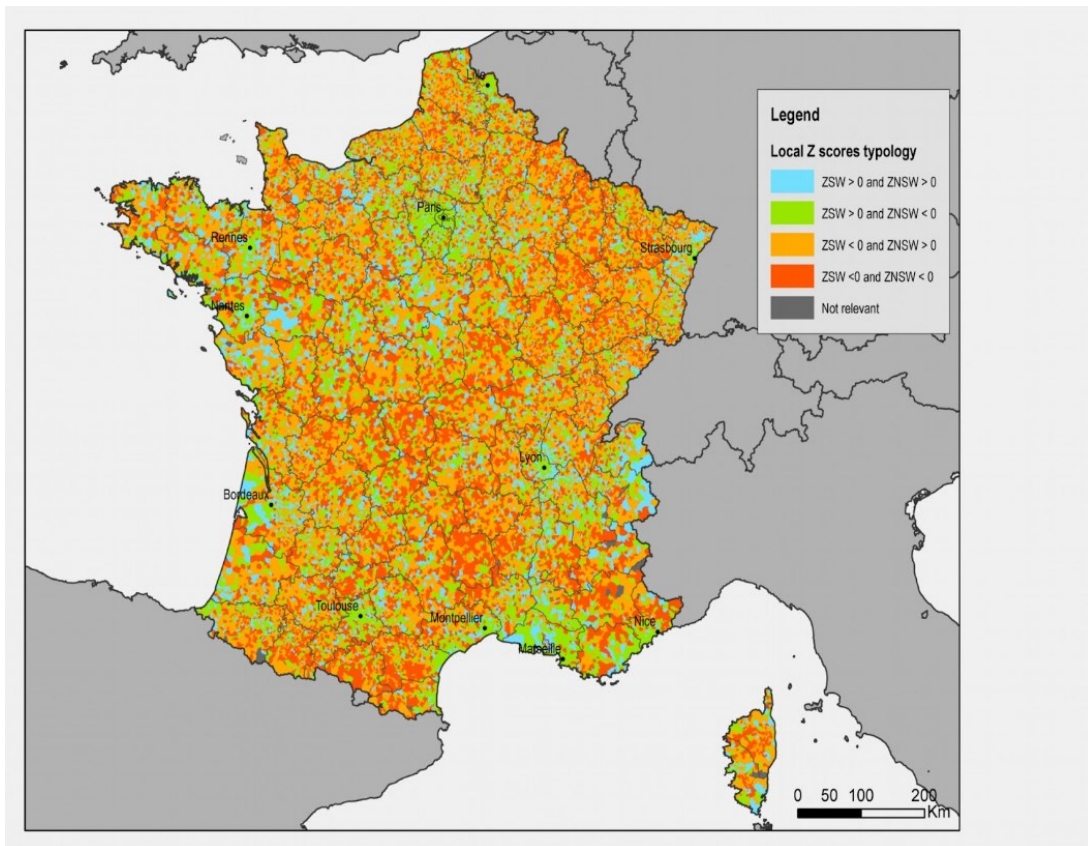


Fig 4 – A qualitative assessment of the smart-working employees vs. traditional employees, using the local Z scores

Class. no. 2 (NSW<0 and SW>0) varies in size from one metropolitan area to another, but one can still detect some logic in this variation. For example, this variation can be explained by the local patterns of spatial accessibility to the metropolitan core, in combination with different degrees of economic extroversion and with the geometry of the administrative frame. In some relevant cases - Lyon, Strasbourg



or Nantes, this type is generally contiguous to LAU composing the first type. This spatial model suggests that the French metropolitan areas are still monocentric and subject to a strong spatial division of concentric economic activities.

Class no. 3 (NSW>0 and SW<0) dominates the French territory and it is associated with the rural areas (rather the economically performing ones). The LAU belonging to this class might not be demographically relevant, compared to the previous type, but given their footprint on the map they should be taken into account in the policy design related to the diffusion of smart-working.

### 3. The impact of smart working on urban and regional mobility – lessons from the COVID19 pandemic period

The impact of the smart working on the regional and urban mobility presents different trends in the 5 countries participating in the project. This impact can be measured and mapped using 2 approaches:

#### 3.1 Mobilization of the data extracted from Google/Apple/Facebook mobility data

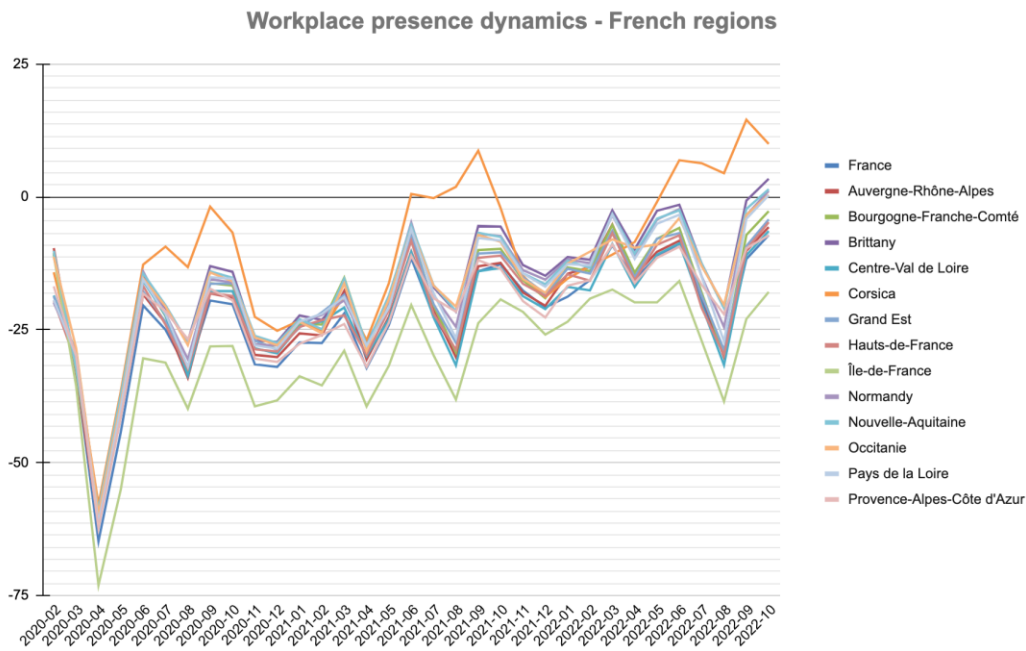


Fig. 5 Workplace presence dynamics during the pandemic - Data source: Google LLC "Google COVID-19 Community Mobility Reports". <https://www.google.com/covid19/mobility/>

The data on mobility was aggregated by month, in order to eliminate a part of the inherent data noise (weekends, celebrations day, free days etc.). The analysis presented in this report focuses on the regional scale, with a noticeable coherence between regions except for two of them. On one hand, Corsica, with its tourism-fuelled economy, stands out from other French regions, particularly in the summer seasons,

when Corsican workers massively go back to the workplace (hotels, restaurants etc.). On the other hand, Île-de-France, which is by far the most urbanized of French regions and can be considered as the Paris metropolitan area, appears to be much more inclined towards smart working than other regions.

Besides these exceptions, 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. One could easily explain this by the central role played by the French government during the pandemic: between March 2020 and February 2022, the Ministry of Labour regularly appeared in the media in order to communicate guidelines for telework in the private sector, going as far as defining a minimum number of weekly teleworked days for private companies. State interference in organizational and managerial issues in the private sector is not commonplace in France, but rather a symptom of a *cas de force majeure* situation. In February of 2022, the government publicly announced in the media that they were “giving back the reins to employers”<sup>8</sup>. A few weeks later, average workplace presence was almost back to their pre-crisis levels. With a few regional differences:

- On one side, Brittany, Nouvelle Aquitaine, Occitanie, Normandy and Pays de la Loire all seem to have gone back to their baseline level of workplace presence since October 2022 (although data for 2022-2023 would be necessary for us to be able to confirm this recovery trend), with an average 17.8 pts average drop in workplace attendance over the 2020-2022 period.
- On the other side, Bourgogne-Franche-Comté, Grand Est, Hauts-de-France, Auvergne-Rhône-Alpes, Centre Val de Loire, Provence-Côte d’Azur, with an average 22 pts drop in workplace presence over the pandemic period, though they follow the same recovery trend as the rest of France, still had not got back to their baseline level

The most surprising aspect of this data lies in the existence of a clear recovery trend in every region. While the calls to “go back to the office” have been widespread since the end of the pandemic, we expected a more visible change in work mobility between the beginning of 2020 and the end of 2022. The data provided by Google, although failing to inform us about what has happened since October of 2022, seems to indicate otherwise. According to us, two factors can explain this recovery trend:

1. The data used by Google does not distinguish between smart workers and non-smart workers. We must bear in mind that most French employees are not eligible for smart working, be it because they are “frontline workers” or because they work with non-mobile technologies. In fact, this recovery trend is primarily, and quite literally, an indication of “people going back to work” after an exceptional short-time working period.
2. Because the level of telework seems to have varied between 25% (pre-pandemic) and 38% (“peak-pandemic”)<sup>9</sup>, this recovery trend also might indicate that smart work did in fact reach its full potential of deployment during the crisis, and then receded when employers recovered their ability to summon employees back to the office. Some of the discussions we have had with HR managers over the last two years would tend to confirm that many employers started, as soon as

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<sup>8</sup> [https://www.lemonde.fr/planete/article/2022/02/03/teletravail-on-rend-la-main-aux-entreprises-annonce-elisabeth-borne\\_6112150\\_3244.html](https://www.lemonde.fr/planete/article/2022/02/03/teletravail-on-rend-la-main-aux-entreprises-annonce-elisabeth-borne_6112150_3244.html)

<sup>9</sup> Using the data provided by the Telework barometer from Malakoff-Humanis.

mid-2020, to worry about being able to make employees come back to the office. There has been, without a doubt, a backslide effect in teleworking habits after the pandemic, most probably because telework was forced onto organisations that were not always ready from a cultural standpoint (at the management level).

Although it is reasonable to expect that the pandemic helped to make smart work more normal in many French territories, this 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.

### 3.2 Environmental effects of smart working

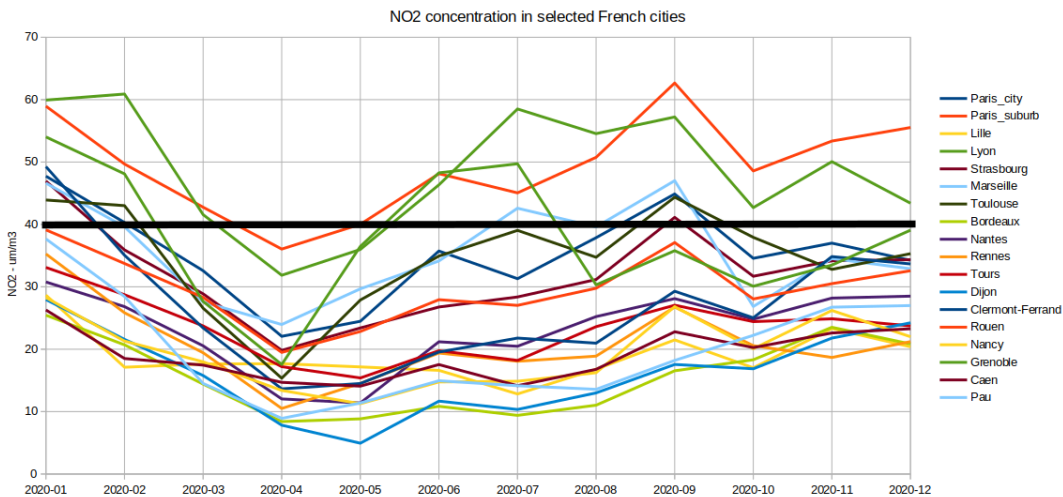


Fig. 6 - NO2 concentration in selected French cities. The black line indicates the danger threshold according to the EU - Data source:

<https://discomap.eea.europa.eu/App/AirQualityStatistics/index.html#>, EEA

The relation 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. This chemical is usually the output of traffics and industrial activities and it was considered relevant for our analysis. Although variations between urban areas can be observed, the overall trends are the same: NO2 emissions plummeted between February and April of 2020 - an average drop of 56 pts, and then progressively recovered until the end of the year. For some of France's average cities such as Rennes (217k inhabitants), Dijon (199k) and Clermont-Ferrand (195k), this initial decrease was more spectacular, with a 70 pts reduction between January and April. On the other hand, the decrease was much less spectacular in the case of some of Paris's suburbs (in our case, Monthlery) and Lille, with a 38 pts drop in NO2 emissions.

We should nevertheless underline that using NO2 concentration data has its limitations when assessing the environmental impacts of smart working. Firstly, because various factors other than car traffic may have impacted average concentrations of NO2 such as industrial activities and topography. For example,

despite the fact that the Bordeaux urban area counts twice as many inhabitants as the Grenoble urban area, the data gathered by the air quality stations used in this report show that average NO<sub>2</sub> concentration was 2.4 higher in Grenoble than in Bordeaux in the year 2020. It is no secret that the mountains surrounding Grenoble act as a pollution trap, while Bordeaux is on the Atlantic shore.

Another key limitation of using local NO<sub>2</sub> data as a proxy for the environmental impact of local smart working practices lies in the fact that ICT-based organizations as well as environmental processes act as multifaceted, complex, interconnected systems. In systems dynamics, feedback loops between processes can spread over time and space, well beyond the limits of a single year and the borders of the French territory. 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.

One of the main lessons we can draw from this data is that the pandemic allowed, in the case of Paris and Lyon, to limit NO<sub>2</sub> concentrations below the safety threshold. One should note that NO<sub>2</sub> is one of the pollutants that French territories have been failing to regulate. Furthermore, in the last 10 years, 2020 was the only instance of an actual reduction in CO<sub>2</sub> emissions. Focusing our attention on the environmental effects of smart working should not hide the fact that the best lever for optimizing greenhouse and other polluting gas emissions is, to this day – as the pandemic has shown – a drastic restriction of production levels, much more than smart working.

#### **4. Framing the bottlenecks impeding the development of smart working in France**

##### **4.1 ITC endowment**

Mapping out broadband coverage in France does not say much about territorial disparities as broadband connectivity (download speeds >3Mb/s) is available on 99,9% of the territory. However, as smart working generally requires a fixed broadband connection, we chose to use the FTTH (fiber to the home) coverage data made available by the ARCEP (the national agency in charge of regulating electronic communications)<sup>10</sup> 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 center of gravity. FTTH connectivity in the southern half of France is somewhat more patchwork-like, with four hybrid metropolitan areas:

- Bordeaux, and the whole coastal area spreading from La Rochelle to Bayonne
- The band stretching from Clermont-Ferrand to Toulouse
- The larger Lyon metropolitan area

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<sup>10</sup> <https://www.data.gouv.fr/fr/datasets/le-marche-du-haut-et-tres-haut-debit-fixe-deploiements/>

- A large band along the Mediterranean coastal area, from Perpignan to Nice, and going as far as Avignon and Grenoble, with Marseille as its center of gravity.

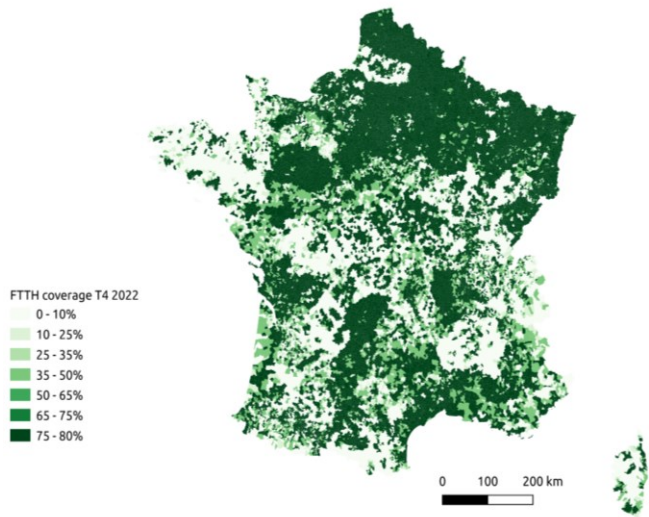


Fig. 7 - Fiber to the home connectivity by commune, T4 2022 - Data source: <https://www.data.gouv.fr/fr/datasets/le-marche-du-haut-et-tres-haut-debit-fixe-deploiements/> ARCEP

On the other hand, three very poorly connected regions emerge: the infamous “diagonal of emptiness” that stretches from southwest to northeast (also visible in the precedent figures), as well as Brittany and the Alps. No clear correlation seems to exist between FTTH coverage and smart working development (fig. 1 to 4) which 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. However, as the French copper network will in fact progressively disappear as the telecom industry abandons it, FTTH coverage might very well play a more important role as a backbone for smart working in the coming years.

#### 4.2 Trends of Internet use

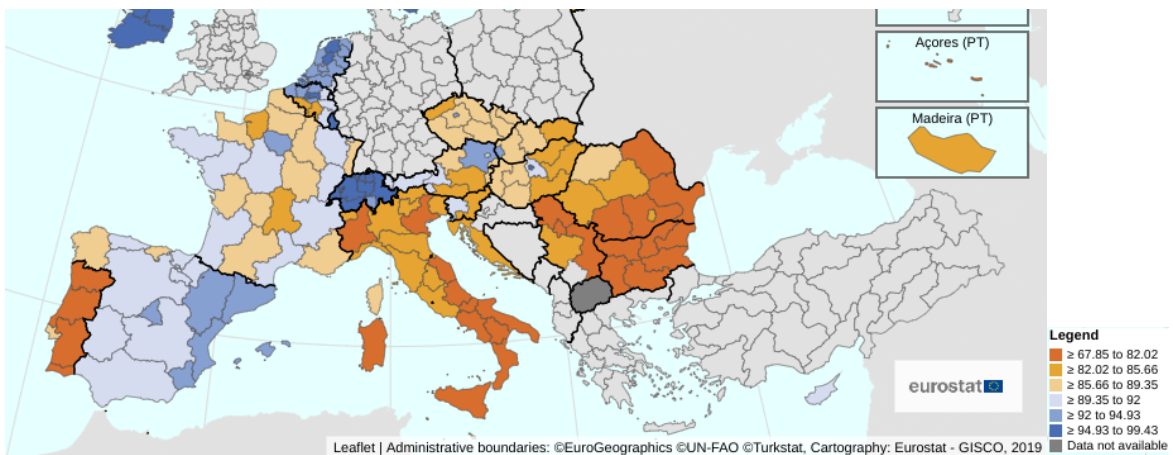


Fig. 8 - Inter-regional disparities at the NUTS2 level Data source: Eurostat 2021 (ISOC\_R\_IUSE\_I series).

When comparing the share of citizens claiming to access the Internet at least once a week at the NUTS2 level, France immediately appears as a contrasted country compared to Spain (where at least 90% of citizens countrywide appears to use the Internet) or Italy and Romania (under 85%). Île-de-France stands out with >92% of intensive Internet users. The periphery of Île-de-France is overall more sober in its use of the Internet, with 85% to 90% of citizens using it on a weekly basis. The FLRO region which comprises Marseille stands out both as a very well-connected region (FTTH coverage is being quite good) and a rather moderate one in terms of Internet usage. Although the provided Eurostat data does not allow for the analysis of intra-regional disparities with the ISOC\_R\_IUSE\_I indicator, there is little doubt that Internet usage is more intense in the Marseille urban area than in the peripheral rural areas.

## 5. Key findings and policy recommendations

### Key findings

- 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.





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