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Intermodal Passenger Transport after COVID-19 Pandemic Breakout

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Abstract

The current paper is based on data collected within the framework of the Inter-Connect PLUS project, with a focus on incorporating new norms before, during, and after the COVID-19 pandemic. A questionnaire was conducted in four countries of the Adriatic-Ionian (ADRION) Region: Italy, Slovenia, Croatia, and Albania. The collected data from the survey was analyzed to draw conclusions about the travel modes citizens used before, during, and are willing to use after the pandemic. The paper closes with recommendations, in the form of a Roadmap, highlighting the potential positive impact of the pandemic on the future of sustainable mobility.

Keywords

urban mobility, COVID-19, sustainability, transportation

1 Introduction

The global outbreak of COVID-19, which originated in Wuhan, China in December 2019, has rapidly spread worldwide, affecting nearly all countries and territories (Zhu et al., 2020). The severity of the situation prompted the World Health Organization (WHO) to declare it a pandemic on March 12, 2020. In response, countries worldwide issued warnings and urged the public to take precautions to safeguard themselves and others. The measures proposed by the WHO included handwashing, wearing face masks, keeping physical distancing, and avoiding large gatherings. Despite these actions, COVID-19 has continued to impose a high toll on human lives. Additionally, the pandemic has had far-reaching consequences on the global economy, leading to increased poverty and other socio-economic challenges (Jackson, 2021).

Governments had to immediately react to the global danger; hundreds of countries around the world enforcing lockdowns to reduce the rate of pandemic's effects (Onyeaka et al., 2021). During this period, the severity of lockdown measures varied significantly from country to country and even within different regions of the same country. The measures linked to mobility can be clustered in three categories; "avoidance of travel", "modal shift" and "improvement of quality" (Shortall et al., 2022). Governments and health authorities implemented a range of restrictions to contain the spread of the virus and protect public health. Lockdowns, besides protecting people's life, had, undoubtedly, it caused a dramatic economic effect and a major transport impact (de Palma et al., 2022); movements reduction, traffic and congestion alleviation (Vagliasindi, 2023), crashes reduction (Jima and Sipos, 2023; Shaik and Ahmed, 2022), environmental conditions improvement (Trček and Kamnik, 2022). Lockdowns affected people's daily life in other ways too, both negatively and positively; impact an impact not only on people's physical and mental health but also on their, working conditions and travel and mobility habits.

Public transport systems experienced significant disruptions and challenges during the COVID-19 pandemic due to concerns about the potential spread of the virus in enclosed spaces (Bulková et al., 2022; Liu et al., 2020; Shelat et al., 2022; Tirachini and Cats, 2020). The fear of contamination led to a decrease in ridership and posed significant challenges for public transportation authorities worldwide.

The shared mobility industry has undergone significant transformations in recent years, facing simultaneously substantial barriers and opposition. COVID-19 outbreak has

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emerged as its most formidable adversary, posing unprecedented challenges to shared mobility services (Shokouhyar et al., 2021). Along with public transportation, shared mobility was affected as the virus can live up to several hours on hard surfaces transforming the vehicles to vectors of transmission. However, on the other side, for cases where responsible shared mobility companies operated, shared vehicles (e-scooters, e-bikes) assisted travelers to implement their trips avoiding crowded buses and without the need of using private cars (Dias et al., 2021; Nikiforiadis et al., 2020).

In addition, the COVID-19 pandemic has had major effects on people's working patterns and careers (Akkermans et al., 2020). For example, healthcare and other frontline workers were working around the clock to provide relevant and dedicated support services, whereas other workers had been forced to work from home, requiring adaptation to on-line and virtual work arrangements. Others experienced job losses facing in parallel serious problems in well-being and mental health (Tušl et al., 2021; Xiao et al., 2021). Employers were also facing significant challenges, including small business owners struggling to keep up with overhead costs. Unemployment and underemployment rates as well as reduced wages drastically increased since the beginning of the pandemic, having a profound impact on people's careers (Blustein et al., 2020).

COVID-19 has brought new challenges to travel behavior while showing that there are factors that influence travel behavior other than traditional considered factors as age, gender, educational status, lifestyle choices, functional area structure and prices (Aguiléra and Grébert, 2014; Siren and Haustein, 2013, Litman, 2021); restrictions effect, perception of risk and personal experience highly affect mobility choices and patterns (Jiao and Azimian, 2021; Neuburger and Egger, 2021).

In the current paper the results of a survey which collected data from Adriatic-Ionian countries, are analyzed to determine the effect of COVID-19 on people's working patterns and mobility habits. The survey was conducted in the framework of the Interreg ADRION project Inter-Connect PLUS (2022) which aimed to investigate the impact of the recent COVID-19 pandemic on passenger transport and promote the adoption of alternative modes of transportation to meet the needs of the Adriatic-Ionian countries.

2 Case studies

2.1 Cities of the Adriatic-Ionian region

The terrain of the specific survey included specific areas included in the Inter-Connect PLUS (2022) project partnership, namely:

- The Italian cities of Bologna, Modena, Reggio Emilia, Parma, Ravenna, Ferrara, Rimini, Forlì-Cesena, Piacenza, and Trieste;
- Ljubljana, Slovenia;
- The Croatian cities of Dugo Selo, Zagreb, Karlovac, Trnovec Bartolovečki, Slavonski Brod, Vukovar, Split, Dubrovnik;
- Durres and Tirana in Albania.

The area of the survey is highlighted (in purple) in Fig. 1.

2.2 The COVID-19 restrictions in the study area

The COVID-19 outbreak in Italy was first detected in late February 2020, specifically in the regions of Lombardy and Veneto. The first confirmed cases were reported on February 21, 2020. It is believed that the virus was present in Italy before the official confirmation, as retrospective studies have identified earlier cases in the country. As in most European Union countries, Italy imposed extensive bans and restrictions. The strictest form of measures was imposed from mid-March to the end of June. On 09 March 2020, the Italian government implemented a nationwide lockdown, which included the closure of schools, universities, non-essential businesses, and strict limitations on people's movements. The use of the mask was imposed from mid-April. National and local authorities adopted a pool of measures to safeguard public health as a primary care, however, the measures implemented to control the spread of the coronavirus had a significant negative impact on Italian businesses, employees, and the overall national economy. The measures have included cancellations of many important events, conventions, and trade fairs. Presidential Decree of 01 March 2020 color-coded certain geographical areas in Italy based on the severity of the spread of the virus and imposed accordingly strict

Fig. 1 The survey area

measures in these areas (Red Zone, Yellow Zone, and Green Zone). During the strict lockdown in March 2020, schools were closed, adaptation of remote working became a priority and employees were present in their offices only when it was strictly necessary. Additionally, it was prohibited to move outside municipality of residence, and a curfew was imposed from 10 p.m. until 5 a.m.

In Slovenia government passed the Decree on the Declaration of Contagious Disease SARS-Cov-2 (COVID-19) on 12 March 2020, declaring first measures: the shutdown included kindergartens, schools, universities, as well as open playgrounds, sports parks, sports training camps, and public transportation starting from 16 March 2020. As of 20 March 2020, it was forbidden to enter public areas and from March 30, 2020, mobility was only allowed within the municipal borders of residential cities. The government disregarded second wave warnings from experts and failed to adequately prepare the healthcare sector to handle the subsequent wave, which quickly spiraled out of control despite more than three months of lockdown measures.

Croatia implemented some stringent measures in response to the COVID-19 pandemic. The first case of COVID-19 in Croatia was registered on the 25th of February 2020, and first measures were introduced on the 09th of March, while schools and universities switched to a full-online learning from 16th of March. Few days later all entertainment and other public venues were closed, including restaurants, movie theatres, gyms, shopping centers and places of worship, culminating in a full lockdown on the 23rd of March, banning free movement of people across countries without a special authorization. After a lockdown phase of 30 days, easing of restrictions began on the 27th of April. On 11th of May, preschool institutions and schools in Croatia reopened, but only for the youngest children in primary education, specifically from first to fourth grade. For older students, online teaching continued until the end of the school year in June.

Days before the confirmation of the first COVID-19 case, Albanian experts expressed concerns about the potential spread of the virus in the country. Immediate measures were implemented following the confirmation of cases, including the suspension of flights and ferries to and from northern Italy. To contain and mitigate the spread of COVID-19, enhanced screening measures were implemented, and quarantine measures were enforced. With a special decree the Government ordered the closure of all educational institutions for a period of two weeks, all sporting, cultural events, and other large public gatherings were cancelled for a period of three weeks. Country's lockdown came into effect from March 10th. The use of private cars and intercity transport vehicles was banned in Tirana and Durres, and all private and public transport was banned in Shkoder, Lezha, Elbasan, Lushnja, Fieri and Vlora, with the only vehicles allowed being ambulances and vehicles for delivering essentials food and health needs. On 13th of March, similar lockdown measures were implemented in other major cities across the country, and on 15th of March, Albania closed all of its land borders until further notice. On 16th of March social, cultural, and political gatherings, both in closed or open-air spaces, were banned, and violators could face fines.

Inevitably, the abovementioned types of measures tremendously impacted the economy, areas' operation and functioning, and people's everyday life.

3 Methodology

To summarize the effects of the pandemic on urban mobility systems in the study area, a questionnaire survey was conducted to citizens of the study area.

Table 1 presents a summary of the number of respondents from each country who participated in the questionnaire.

As mentioned above, the aim of the questionnaire was to collect data about the effect of COVID-19 on the working status and patterns as well as general travel habits (March 2020 – March 2022). The research focused on the primary mode of transportation used by citizens and examined how it changed or remained consistent before, during, and after the pandemic, taking into account the restrictions implemented by the governments to prevent virus' spread.

The three main periods/phases that was used for the specific survey are:

- Phase A (February 2020 – June 2020): Complete lockdown;
- Phase B (July 2020 – October 2020): Release of measures;
- Phase C (November 2020 – March 2022): Light lockdown / on-off measures.

Table 1 Collected data from Inter-Connect PLUS project (Inter-Connect PLUS, 2022©)

Country	Number of questionnaires
Italy	351
Slovenia	58
Croatia	58
Albania	56

After the survey was completed (Inter-Connect PLUS, 2022), an integrated database was created in Excel, incorporating the data collected from different countries.

4 Results

4.1 Key findings related to the impact of COVID-19 on working status and patterns

The respondents were asked about the effect of the COVID-19 in their working status per COVID-19 phase (multiple choices; 'Got a new job', 'Nothing changed', 'Shift to teleworking', 'Job loss', 'Other').

Additionally, participants were queried about their commuting mode prior to the pandemic and any changes they made during the three phases of the COVID-19 period, aiming to assess the influence of the pandemic on modal choices.

From Fig. 2 (a) we can see that the primary impact of the complete lockdown was the shift to teleworking. Additionally, a significant portion, accounting for 7% of the total respondents, reported job loss during this period.

During the second period (Fig. 2 (b)) when a release of measures took place, the survey revealed that there was a decrease of the percentage of people who lost their jobs while at the same time there is also an increase of those who got a new job. Similar are the results for the third phase (Fig. 2 (c)).

A comprehensive analysis of public reports was conducted to further validate the findings on the impact of COVID-19 on employment rates in each participating country.

The employment market in Italy has been impacted by the COVID-19 pandemic, although the effects have been partially mitigated by short-time work programs and the suspension of layoffs. However, the effects of the lockdown on employment levels have not yet manifested. The cushion provided by social safety nets and the suspension of the layoffs have limited the short-term effects of COVID-19 on the labor market. At the end of March 2020, the Italia National Institute of Statistics (ISTAT) registered a decrease in the unemployment rate relative to March 2019, i.e., −11.1%, while the employment rate only decreased by 0.1%. The decline in unemployment continued in April, reaching the lowest figure since 2007. This, however, reflected a considerable increase in the number of economically inactive people. At the same time, the employment rate in April only decreased by 1.2% with respect to March 2020. Since July 2020, employment has started growing at a constant rate (+0.4% on a monthly basis). However, employment levels in August 2020 were still 1.8% lower than the ones registered in August 2019. Another study also shows

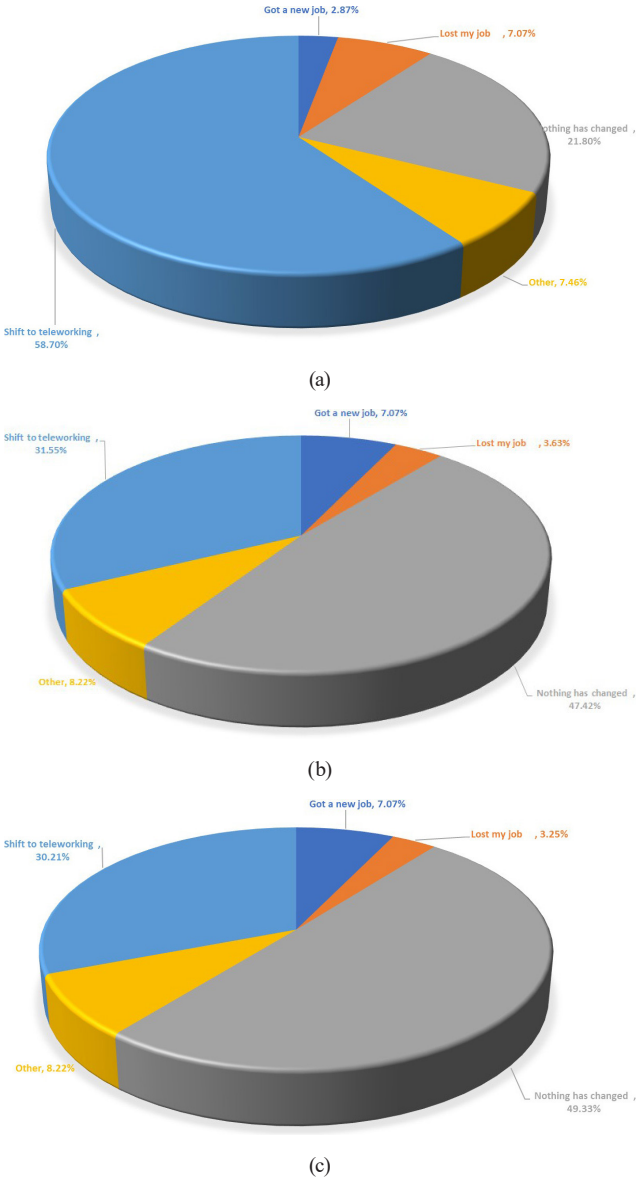

Fig. 2 The effect of COVID-19 on the working status during; (a) the primary impact of the complete lockdown (Phase A); (b) the second period of the lockdown (Phase B); (c) the third period of the lockdown respectively (Phase C)

how, between the first and the second wave of the survey, large adjustments took place in the Italian occupational structure. The share of idle workers dropped from 47% to 34%, while the share of individuals working in the regular workplace increased from 18% to 25% and that of those working from home from 35% to 41%.

The COVID-19 crisis put the employment relationship in Croatia to the test as employers faced challenges in keeping their businesses afloat while ensuring the well-being of their employees. The pandemic had a significant impact on the economy, leading to financial struggles for many businesses. As a result, employers had to make

difficult decisions to adapt to the changing circumstances and preserve their operations. These challenges created uncertainty for employees who faced concerns about job and income stability and about shifts in work-life balance. Government interventions and support measures played a crucial role in mitigating the impact on employment, aiming to provide assistance and stability during such challenging times. According to recent statistics Croatia has suffered from high levels of unemployment for years, however the rate has been steadily decreasing in the last few years. In January 2016 it was 17.3%, which dropped to 8.4% in January 2020. Normally, the rate is at its lowest in the summer months because of many people working seasonal jobs in the tourism sector, but in 2020 unemployment started to rise in April. In March 2020 the unemployment rate was 8.6%, almost the same as in March 2019 (8.8%), but then it rose to 9.4% in April 2020 while in April 2019 it was 8%. The current number of unemployed persons in Croatia (April 2020) is 159,234, which 15,773 more than in March and 21,257 more than in February, which means that around 20,000 people lost their jobs during the COVID-19 crisis. It is important to note that during these months, the employment situation was significantly influenced by government measures implemented to preserve employment. These measures played a crucial role in mitigating the impact of the crisis on the labor market, providing support and assistance to businesses and workers. Without these measures, the situation could have been more severe, with potentially higher unemployment rates and greater economic hardship. The government's proactive approach in implementing employment preservation measures helped to stabilize the situation and alleviate some of the negative effects caused by the crisis.

COVID-19 has had a devastating impact on Albanian businesses, but it is important to note that Albania is not alone in experiencing such effects. A significant majority of firms in the country, approximately 71%, reported a decline in demand, leading to a substantial decrease in sales by around 52%. These figures highlight the widespread and severe economic consequences of the pandemic, affecting businesses across various sectors. The decline in demand and sales puts significant strain on the financial stability and sustainability of Albanian firms, requiring them to adapt and navigate through these challenging times. 28% of firms reduced the number of permanent workers and consistently 11% of permanent full-time workers lost their job. Also, remarkably large share of Albanian firms reported adjusting their operations in response to the crisis (77%) but, despite recent strong process in digitalization, moving towards online activity or remote work was proven relatively difficult. 18% of firms reported starting or increasing online business activity, but only 15% of Albanian firms reported shifting to remote work modalities.

During the first wave of the pandemic in Slovenia, the manufacturing sector experienced the most significant decline in the number of employed persons. This sector was particularly affected by disruptions in the global supply chains, reduced demand for goods, and limitations on production activities. Decreases in employment occurred mostly in the private sector and among young people up to 29 years old. COVID-19 pandemic highly increased the number of teleworkers. According to a survey, although teleworking became much more frequent due to the pandemic, it went down considerably in the second wave.

From the above-mentioned information, it becomes obvious that in all the countries of our survey the employment rate was decreased during the complete lockdown and our results seem to represent the reality.

Based on the information provided above, it is evident that the employment rates in all surveyed countries experienced a decrease during the complete lockdown period while after the end of the first wave of measures, a gradual return to workplaces started.

4.2 Key findings related to the impact of COVID-19 on mode choice

The next interesting outcome of the survey is the impact of the COVID-19 on the transport mode choice; walking and cycling was highly selected as main mode of transport for the rest daily (allowed) trips of people that have shifted to teleworking.

As it is presented in Fig. 3 when the respondents were asked if they would change their modes of transport for their trips to work after the pandemic, the majority answered yes and were willing to shift to bike, public transport and car. The same intention was also mentioned for the other trip purposes too (shopping, leisure).

A more detailed analysis of the above-mentioned results was conducted in each country to gain a better understanding of the different attitudes towards the possible modal shift towards more sustainable modes brought about by COVID-19.

In Italy, it seems that car and bike use increased during COVID-19 while the use of public transport decreased particularly during the complete lockdown period. Also walking seems to have increased its share but it remains a low preferred travel mode (the least preferred is taxi).

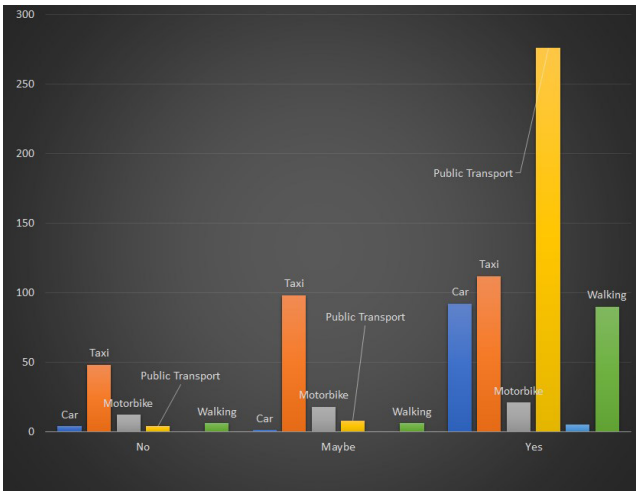

Fig. 3 Respondents' willingness to adopt sustainable modes of transport for work and mode preferences

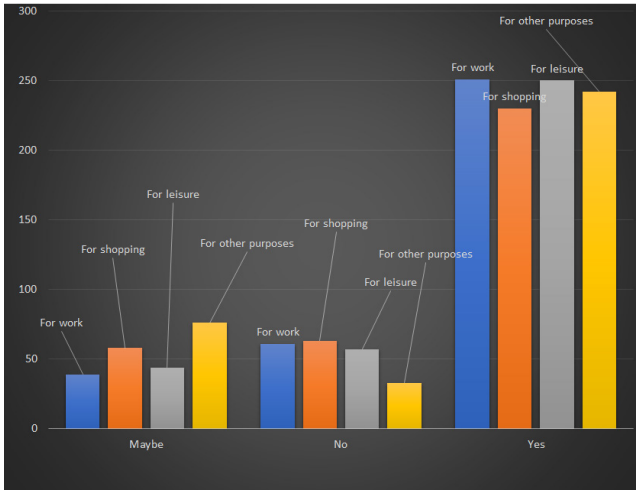

Fig. 4 Willingness of respondents to shift to sustainable modes of transport after the pandemic in Italy

The analysis of the respondents' willingness to shift modes of transport after COVID-19 is reflected in the results presented in Fig. 4. According to the findings, 71% of the respondents expressed a positive inclination to shift to sustainable modes of transport for work once the pandemic subsides. On the other hand, 18% of the respondents displayed a negative inclination towards this shift, while 11% were unsure or undecided about their future mode of transport.

As regards the mode that the respondents intend to use after the pandemic, the analysis showed that they will prefer to use:

- car, bike and public transport for moving to/from work;
- car, bike and walking for shopping;
- car, bike and less walking or public transport for leisure;
- car, bike, public transport and less walking for other purpose.

More specifically, the survey results indicate that among the respondents, 38% expressed their intention to use a car for their trips to and from work. Additionally, 27% of the respondents stated their preference for using a bike as their mode of transportation, while 23% expressed their intention to use public transport. Walking was chosen as the preferred mode by 6.5% of the respondents. It is worth noting that a small percentage of respondents showed a preference for motorbikes and taxis as their mode of transport for work-related trips.

The car remained the main travel mode during all COVID-19 phases in Slovenia (Fig. 5).

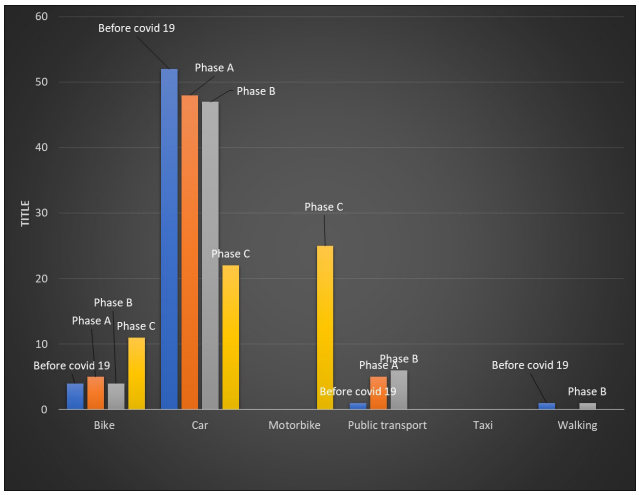

Fig. 5 Main travel mode in Slovenia before and during COVID-19 phases

The vast majority of Slovenians are willing to shift to sustainable modes of transport after COVID-19 for work and leisure (Fig. 6).

It seems that in Slovenia most of the people did not trust the public transport system and also, they didn't believe that bike can be a good alternative mode of transport. It seems, COVID-19 gave the opportunity to use active mobility, and this can be an opportunity for changing citizens behavior towards sustainable mobility.

Car and public transport were the main travel modes that citizens used both before and during the pandemic in Croatia. In phase A, car use and walking increased while public transport experienced a big drop mainly during the first phase (Fig. 7). The low use of sustainable modes of transport, even before the pandemic outbreak, may be attributed to factors such as the lack of appropriate infrastructure, insufficient

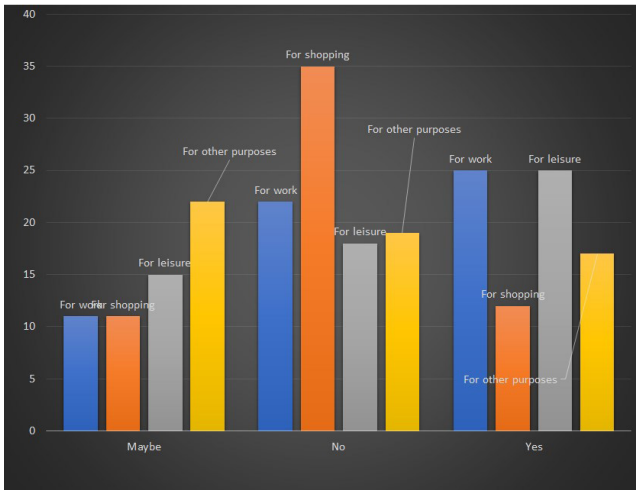

Fig. 6 Willingness of respondents to shift to sustainable modes of transport after the pandemic in Slovenia

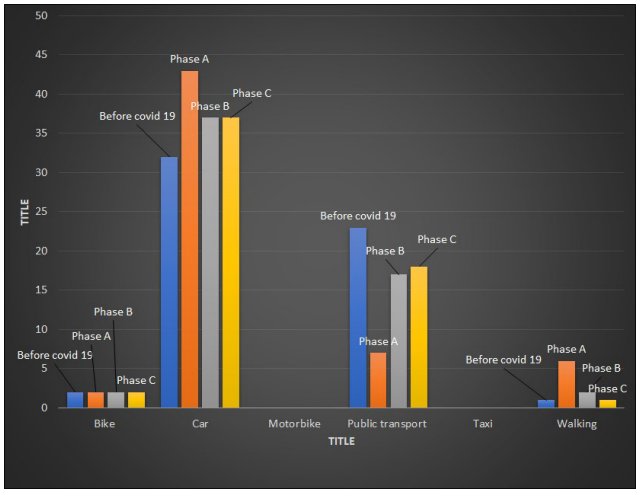

Fig. 7 Main travel mode in Croatia before and during COVID-19 phases

promotion of active travel, inadequate regulation, and a limited legal framework, among others.

Although not so sustainable mobility users, most Croatian respondents claimed to be willing to shift to sustainable modes of transport after the pandemic for any trip purpose (Fig. 8). This could be a great starting point for the country as the share of cycling and walking is very low.

Lastly, in contrast with the other countries, in Albania walking has been one of the main modes of travel since the beginning of the pandemic (Fig. 9). We can also see that before COVID-19 public transport was used a lot – this is partly explained due to the fact that Tirana (from where the majority of answers came) has a relatively good public transport connectivity compared to other Albanian cities.

Most Albanian respondents are indeed willing to shift to sustainable modes of transport after the pandemic (Fig. 10).

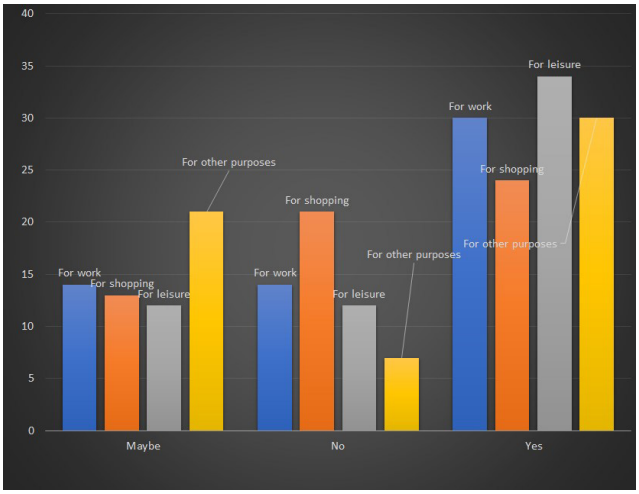

Fig. 8 Willingness of respondents to shift to sustainable modes of transport after the pandemic in Croatia

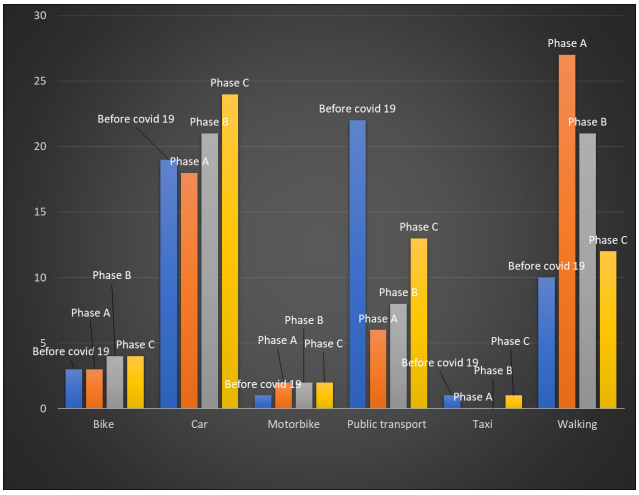

Fig. 9 Main travel mode in Albania before and during COVID-19 phases

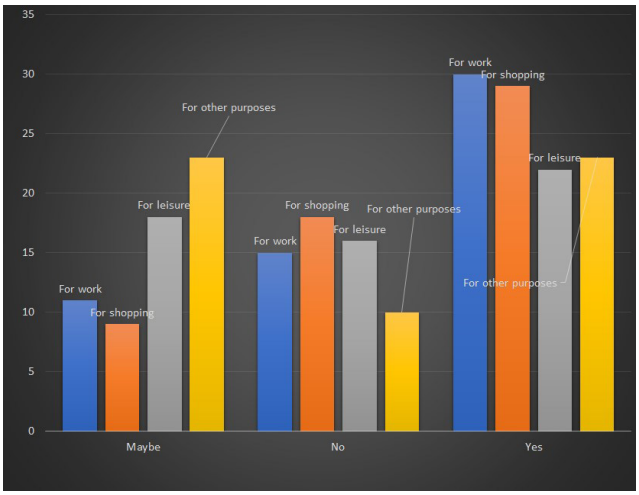

Fig. 10 Willingness of the respondents to shift to sustainable modes of transport after the pandemic in Albania

In Tirana it seems that walking and biking can become two very strong alternatives of car for the daily trips accompanying the well – so far – received public transport system.

4.3 Analysis of the factors influencing behavioral change towards sustainable modes of transport

The analysis presented above gave a first impression of the respondents' willingness to shift to more sustainable modes of transport in the after COVID-19 era. A multiple regression analysis was conducted to understand the main factors influencing respondents' choice towards sustainable mobility and how these factors are correlated.

To proceed with this analysis an SPSS database was structured and after quantifying the data, multiple linear regression was performed, in which it is possible to determine all possible correlations of the existing variables. The correlation of each variable is determined by a value of 0.60 or more. As variables approach 1, the more closely correlated they are, while as they approach 0, the correlation decreases. Therefore, a correlation of all variables was performed to identify those that exceed 0.60. The variables with values above 60% have a good correlation, and therefore one variable influences/changes the other.

In the sample analyzed, 3 pairs of variables were identified that have a high correlation with each other.

The first pair (Fig. 11), which was identified is questions {Question Q6–Q13} = 0.651, which correspond to the questions "What was the main mode of travel of respondents during the complete lockdown" and "What is the main mode of transport that respondents intend to use for work after COVID-19?".

This correlation suggests that the mode of travel during the lockdown period influenced respondents' choices for post-COVID-19 travel. Specifically, those who primarily used their own car and bicycle during the lockdown continued to prefer these modes of transport for work after the pandemic.

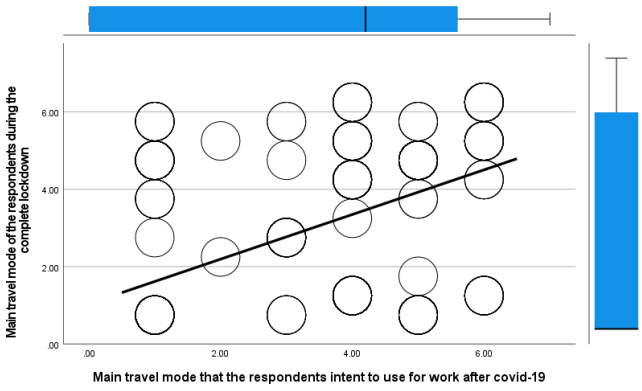

Fig. 11 Correlations of multiple linear regression variables: {Question Q13–Q8}

Public transport and taxis, on the other hand, were less common during the lockdown and had a reduced influence on travel choices for work in the post-COVID-19 period.

The second pair of questions (Fig. 12) {Question Q13–Q8} = 0.751, which correspond to the questions "Main travel mode of the respondents during the complete lockdown" and "Main travel mode of the respondents during light lockdown- on-off measures".

This correlation indicates that during the period of light lockdown-on-off measures, people continued to prefer using their cars as the main mode of transport for work, while the choice of bicycles decreased. However, the differences in mode of transport between the complete lockdown and light lockdown-on-off measures were not significant. This correlation provides insights into the influence of the mid-lockdown period on individuals' choice of transportation for commuting to work.

The third pair of questions (Fig. 13) {Question Q6–Q7} = 0.756, which correspond to the questions "Main travel mode of the respondents during the complete lockdown" and "Main travel mode of the respondents during the release of measures".

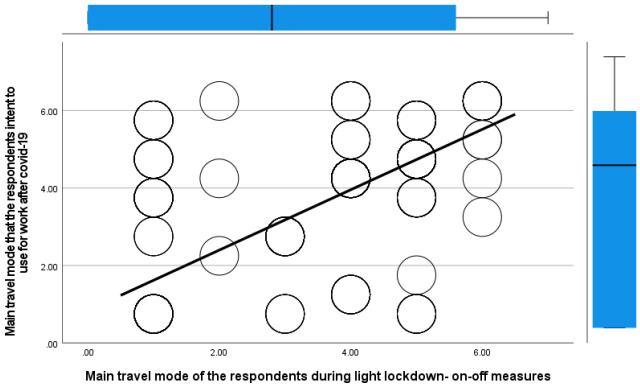

Fig. 12 Correlations of multiple linear regression variables: {Question Q13–Q8}

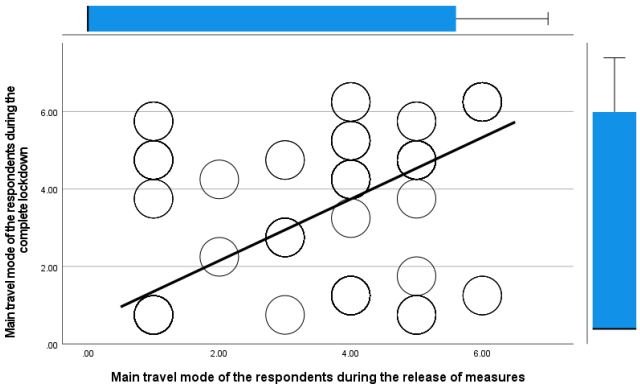

Fig. 13 Correlations of multiple linear regression variables: {Question Q6–Q7}

It is obvious that the period of the complete lockdown, affected people's mode of travel, increasing the use of car and bicycle, while at the same time reducing the use of public transport and taxi. After COVID-19 the choice of transport is based on limited interaction with people rather than on the perception of more environmentally friendly means of transport. The fact that both car and bicycle use has increased rapidly reveals such a pattern of perceptions in relation to everyday transport.

It is evident that the three periods of COVID-19 had a significant influence on people's mobility patterns, although the relative differences between the periods are not substantial. However, the correlations mentioned above clearly indicate that the choice of transportation mode for work was influenced by the ongoing COVID-19 pandemic. The increase in car usage and bicycle usage can be attributed to the fear of crowded spaces, which serves as a limiting factor for these choices. This is supported by the significant decline in the use of public transport and taxis, while private transportation has seen an increase.

5 Recommendations

The COVID-19 pandemic has had a profound impact on various aspects of people's lives, including their mental and physical well-being, daily routines, habits, and travel patterns. The findings from the survey presented in this paper emphasize the need for governments to take proactive measures to maintain and encourage the positive shifts towards sustainable mobility that have emerged during the pandemic. These shifts, such as the increase of cycling and walking, present an opportunity for reaching sustainability goals. By implementing supportive policies, investing in infrastructure, and raising awareness, governments can foster a continued transition towards sustainable mobility.

On the other side, at the onset of the pandemic, people were concerned about the risk of infection, leading them to rely more heavily on their personal cars and avoid public transport. This trend has persisted throughout COVID-19 pandemic phases, resulting in a significant number of individuals continuing to choose their cars during the period after the pandemic. This not only contributes to traffic congestion but also exacerbates issues related to noise and air pollution due to increased emissions from cars. However, it is encouraging to observe that, as proven with the above survey, a considerable number of people have embraced alternative modes of transportation such as cycling and walking for their daily activities. This indicates at least a willingness among the population to adapt their mobility habits and presents an opportunity for a shift towards more sustainable transportation options that governments and local authorities should grasp this opportunity to address the challenge and opportunities presented by the COVID-19 pandemic. By recognizing the shifts in mobility patterns and the increased willingness of people to adopt sustainable modes of transport, governments can take proactive measures to promote and support sustainable mobility initiatives. This may include investing in infrastructure for walking, cycling, and public transport, implementing policies that prioritize sustainable modes of transport, and promoting behavior change campaigns to encourage the adoption of greener transportation options. By seizing this opportunity, governments can contribute to a more sustainable and resilient future.

Fig. 14 is a Roadmap towards supporting the shift that started through the pandemic.

What is evident is that the initial proposed Inter-Connect ROADMAP is valid as it is in all its components, the prioritization and time horizons. In the long run, the ROADMAP will maintain the vision and the principles of sustainable intermodal passenger mobility and will proceed with the implementation of all measures. The experience we gained from the pandemic so far indicates some actions to be taken in the short term. The decalogue of priorities is:

- To regain the lost ground in terms of modal split at the expense of public transport (awareness raising for sustainable mobility).

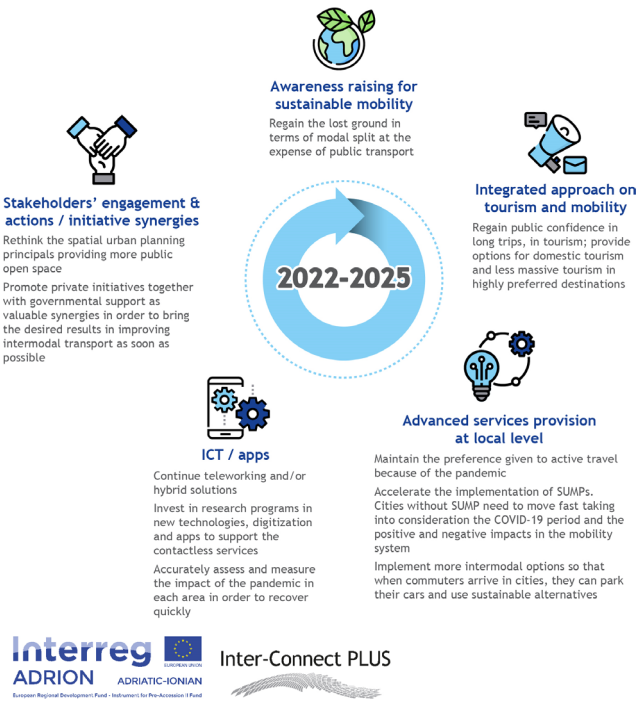

Fig. 14 Inter-Connect PLUS roadmap towards grasping COVID-19 opportunity for sustainable mobility (Inter-Connect PLUS, 2022©)

- To regain public confidence in long trips, in tourism; provide options for domestic tourism and less massive tourism in highly preferred destinations (sustainable tourism promotional campaigns) (Rodrigues et al., 2021).
- To maintain the preference given to active travel because of the pandemic (advanced services provision at local level) (De Vos, 2020).
- To rethink the spatial urban planning principals providing more public open space (stakeholders' engagement & actions / initiative synergies).
- To accelerate the implementation of SUMPs. Cities without SUMP need to move fast taking into consideration the COVID-19 period and the positive and negative impacts in the mobility system (advanced services provision at local level). Citizens' participation in new era of SUMPs would be at the heart of the planning procedure – advanced actions for engaging them should be exploited (Morfoulaki et al, 2022).
- To implement more intermodal options so that when commuters arrive in cities, they can park their cars and use sustainable alternatives (advanced services provision at local level) (Oeschger et al., 2020).
- To continue teleworking and/or hybrid solutions (ICT/Apps).
- To invest in research programs in new technologies, digitization and apps for serving emerging needs i.e. contactless services and personalized support (ICT/Apps) (UITP, 2021).
- To accurately assess and measure the impact (not just in theoretical level) of the shock events in each area in order to recover quickly (ICT/Apps).
- To promote private initiatives together with governmental support as valuable synergies in order to bring the desired results in improving intermodal transport as soon as possible (stakeholders' engagement and actions / initiative synergies). Enhancing collaboration and coordination among multiple levels of governance is an unlocking key for development (Lozzi et al., 2020).

New external factors such as the economic crisis and the war in Ukraine should also be continuously considered in the post COVID-19 era. The pandemic has shown us the importance of being prepared for changes and shock events – resilience is a buzz word and simultaneously a major need.

6 Conclusion

In conclusion, while the COVID-19 pandemic has had devastating consequences globally, it has also brought about opportunities for positive change. The survey results from the Inter-Connect PLUS (2022) project shed light on the potential for a transition towards sustainable modes of transport. By leveraging these findings, it is possible to pave the way for a future where sustainable mobility plays a central role, benefiting both individuals and the environment. Recommendations based on these conclusions can guide future policies and initiatives aimed at fostering sustainable transportation systems.

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