

# IMPACT OF COVID 19 ON MOBILITY, ACCESSIBILITY AND LIVELIHOODS OF MARGINALISED GROUPS IN RUHR AREA, SAO PAULO AND CAPE TOWN

## PART I: BRIEF PRESENTATION

### 1. Original task with scientific and technical status

To guide the research process, we developed Work Packages that informed the conceptual framework which guided data collection and analysis, integrating qualitative and quantitative methods to capture COVID-19's impacts on marginalized groups. Illustrative cases across cities informed a comprehensive livelihood framework, as outlined in the proposal.

**Work package 2:** Situation Analysis (Month 1 to 4): This phase of the research aimed to systematically examine the impact of COVID-19 on livelihoods and the governmental measures implemented in response. For our analysis in Germany, we compiled a comprehensive timeline of COVID-19 regulations spanning from early 2020 to August 2022.

**Work package 3:** Criticality Assessment (Month 5 to 17): This work package addressed the first objective: to analyse the criticality of second- and third-order impacts from disruptions to infrastructure and services on the livelihoods of marginalized groups. It focused on assessing the cascading effects of COVID-19-related mobility restrictions and infrastructure disruptions to answer the research question: What are the indirect effects of COVID-19 on the livelihoods of marginalized groups due to disruptions of infrastructure and services? Using a cascading effects model, the analysis traced how disruptions in one sector triggered broader systemic impacts, amplifying vulnerabilities, affecting livelihoods, and deepening social inequalities.

**Work Package 4:** Mobility Biographies (Month 11 to 29): Work Package 4 addressed the objective of exploring how the COVID-19 pandemic impacted the livelihoods, mobility, and accessibility of marginalized urban populations. It specifically sought to answer the research question: *What are the direct effects of COVID-19 on the livelihood and mobility of marginalized groups?* The Work Package examined both direct and indirect effects across three time periods: pre-pandemic (2019), during lockdown (2020), and post-pandemic (2023/2024). The data collected through 91 household interviews in the Ruhr Area provided both qualitative and quantitative understanding of changing mobility patterns, access to essential services, and activity participation of various marginalised groups. These findings informed the analysis carried out in WP5.

**Work Package 5:** Accessibility Mapping (Month 15 to 36) was nested within Work Package 4, with the findings and data gathered directly informing the analysis conducted in WP5. This integration ensured a seamless flow of information between the two work packages such that the outcome of WP4 guided the spatial and temporal evaluation of households' accessibility and mobility in WP5. This work package specifically aimed to assess travel opportunities and accessibility challenges experienced by marginalized groups by addressing the research questions: *How has COVID-19 changed the livelihoods and mobility of marginalized groups?* and *What accessibility opportunities and challenges have resulted from COVID-19 among marginalized urban dwellers in terms of both physical and virtual access?* In line with the third objective of understanding the changing roles of virtual versus physical access for marginalised groups, our study specifically investigated the constraints on movement and access to essential activities for some selected households within each of the clusters identified in WP4. These households constituted the *Illustrative Cases*.

**Work Package 6:** Livelihood Assessment (Month 30 to 36) developed a framework for sustainable livelihood trajectories as an analytical tool to assess the impacts of COVID19 pandemic along key livelihood assets that included human, social, financial, physical, and

digital capital. Based on a cluster and thematic analysis, we identified subgroups and developed narratives that traced the coping mechanisms for different households before, during and after the pandemic. The comparative analysis highlighted both context-specific differences and coping mechanisms including physical adjustments and virtual strategies. Our framework for sustainable livelihood trajectories shows recovery as a cyclic process rather than a simple return to pre-pandemic conditions and highlights the need for policy responses that promote equitable accessibility and strengthen the resilience of marginalised groups.

**Work Package 7:** Summary or research findings and Dissemination (Month 21 to 36): Various dissemination activities were undertaken by the ICOLMA research team to share findings with academic, policy, and public audiences. These activities included conference presentations, planned workshops, publications, stakeholder engagement events and an animated video for the research findings.

## 2. Project progress

Although the timelines differ between the cities, the same research framework is replicated across all the case study cities. All planned working steps and outputs were achieved. Despite delays caused by external factors, the time planning and expenditures are in line with the workplan of the proposal. 1st Consortium Workshop (June 2022), 2nd Consortium Workshop (Nov to Dec 2022), 3rd Consortium Workshop (March/April, 2023), 4th Consortium Workshop (Feb 2024), 5th Consortium Workshop (November 2024). Validation Workshops: To fortify the validity and reliability of the developed cascading effects, validation workshops were conducted in each of the three case study areas: September 2023, Dortmund, September 2023, São Paulo, and November 2023, Cape Town.

## 3. Essential results

The COVID-19 pandemic exposed and deepened existing inequalities among marginalized households, particularly in terms of financial security, digital access, and emotional wellbeing. Some households were largely excluded from online services due to unstable internet, language barriers and low digital literacy, while others leveraged online learning to maintain educational and financial progress. Reliable digital infrastructure did play a critical role in recovery measures of marginalized households. Mobility restrictions triggered cascading effects across multiple sectors, reinforcing structural inequalities. These insights provide a foundation for further research and policy recommendations aimed at building more resilient and inclusive infrastructure systems.

Both financial and mobility-related impacts of the COVID-19 pandemic were uneven across household clusters with deep disparities in resilience and recovery. The analysis shows a strong interconnection between financial hardship and reduced mobility, yet recovery paths diverged: some households resumed travel despite ongoing financial struggles, while others improved financially but remained mobility-constrained. Overall, the pandemic has led to long-term shifts in both commuting behaviour and household livelihoods, with some groups still bearing the burden of the crisis while others have adapted or rebounded. At the same time, unequal digital access such as low digital literacy and the inability to shift work online left some households excluded from online services while others with better digital access were able to sustain education and income generation. This highlighted the role of reliable digital infrastructure for post-pandemic recovery.

## 4. Cooperation with other organisations

The research team worked closely together with the partners at University of Cape Town, University of Western Cape, both South Africa and FEDERAL UNIVERSITY OF ABC, Brazil. In all case study cities, ICOLMA collaborated with local institutions and initiatives.

## PART II: IN-DEPTH PRESENTATION

### 1. Utilisation of the grant and the results achieved in detail, with a comparison of the specified objectives

This report addresses the central research question: **How has COVID-19 affected accessibility and socio-spatial inclusion of marginalized groups, and how can their resilience be supported or improved through equitable accessibility?** In order to answer this question, the project had four key objectives:

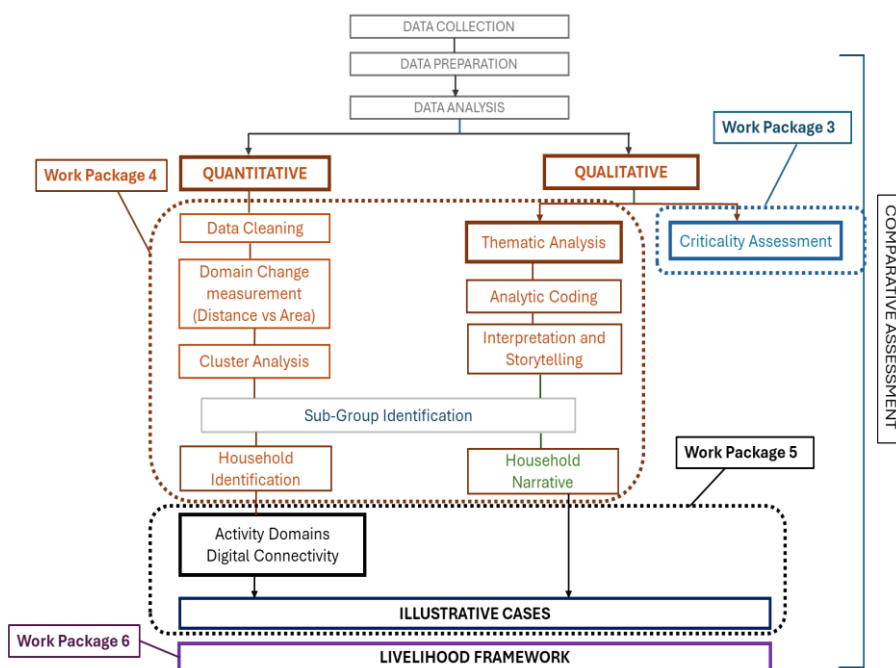
- To analyse the criticality of second- and third-order impacts resulting from disruptions to infrastructure and infrastructure services on the livelihoods of marginalized groups
- To explore how the COVID-19 pandemic has affected the livelihoods, mobility, and accessibility of marginalized urban populations
- To examine the evolving role of virtual versus physical access for these groups during the pandemic
- To assess the impacts of COVID-19 across different livelihood assets and provide policy recommendations that promote equitable accessibility and resilience

The research question and objectives were addressed through a series of work packages (WP) that entailed various methodologies including Criticality Assessment (WP3), Mobility Biographies (WP4), Accessibility Mapping (WP5), and the Livelihood Framework (WP6), all of which are explained in the subsequent chapters.

The flow of work in the project was organized into distinct work packages, each addressing a specific phase or aspect of the research process.

#### Work package 1: Inception Phase (Month 1 to 3)

The inception phase established a collective roadmap and city-specific action plans, including legal approvals and tailored methodological designs. Initial identification of the target marginalized groups was intensively discussed by all the research partners to achieve a common understanding of marginalization. Workshops in each city and a consortium meeting aligned research agendas, while scholarship frameworks supported selected candidates. To guide the research, a conceptual framework structured data collection and



analysis, integrating qualitative and quantitative methods for a multidimensional view of the impacts of COVID-19 on marginalised groups. The flow diagram (Figure 1) outlines the relationships between the methodologies, data sources, and analysis steps applied to all three case studies. We applied a mixed-method approach across Work Packages 3–5.

Figure 1: Workflow Diagram for the ICOLMA Analysis

Quantitative analysis involved data cleaning, measuring domain changes, and cluster analysis to identify sub-groups and household patterns. These results informed the qualitative analysis for deeper assessment. This involved both the thematic analysis and the criticality assessment. The criticality assessment focused on assessing the cascading effects of COVID-19-related mobility restrictions on various groups while the thematic analysis was carried out through familiarisation, coding, generating themes, and testing validity based on the findings of the cluster analysis.

The results of the cluster analysis and thematic analysis enabled us to take a deep dive into the experiences of households through an interpretation and storytelling phase, allowing us to develop illustrative cases. These illustrative cases provided an understanding of household strategies and coping mechanisms. Finally, insights from these cases fed into the development of a livelihood framework, which highlighted recovery needs and pathways for resilience.

## **Work package 2: Situation Analysis (Month 1 to 4)**

As outlined in our project proposal, this phase of the research aimed to systematically examine the impact of COVID-19 on livelihoods and the governmental measures implemented in response. For our analysis in Germany, we compiled a comprehensive timeline of COVID-19 regulations spanning from early 2020 to August 2022.

To provide a clear overview of policy changes, we structured the data in a detailed table, visually resembling a Gantt chart. The table documents the various restrictions and their duration, offering insight into how measures evolved throughout the pandemic. Main categories are:

- **Movement Restrictions:** Differentiating between international, domestic, and local travel limitations, as well as stay-at-home orders
- **Social Distancing Rules:** Covering household-specific restrictions and limits on gatherings exceeding five, ten, or fifty people
- **Impact on Daily Life:** Highlighting closures of schools, kindergartens, workplaces, restaurants, close-contact services, retail stores, and cultural venues
- **Health and Safety Regulations:** Tracking the implementation of mask mandates, availability of free COVID-19 testing, and access to vaccinations

This chronological mapping of regulations helps illustrate the shifts in policy over time, reflecting the government's strategy to adapt measures based on infection rates and public health concerns.

### **Governmental Response in Germany**

The COVID-19 pandemic led to a wide range of governmental responses worldwide, with each country adopting different strategies to manage the crisis. Germany's first confirmed case of COVID-19 was reported on January 27, 2020. As infections began to rise, the government introduced strict containment measures, including a nationwide lockdown in March 2020. Then-Chancellor Angela Merkel urged the public to reduce social contact and stay at home whenever possible. Schools and non-essential businesses were shut down, travel was heavily restricted, and gatherings were limited. Public health campaigns promoted hygiene practices such as frequent handwashing and wearing masks.

From June to mid-October 2020, restrictions were gradually lifted, allowing schools to reopen, businesses to resume operations, and social distancing rules to be relaxed. However, as cases surged again in the autumn and winter months, Germany entered another lockdown from mid-October 2020 to March 2021. With the introduction of vaccines, measures were adjusted in spring and summer 2021, shifting to a more flexible approach where restrictions

varied based on regional case numbers and individual vaccination status. Eventually, after more than three years of pandemic-related regulations, all federal COVID-19 measures were lifted in April 2023, as announced by Federal Minister of Health Karl Lauterbach.

Throughout the pandemic, Germany faced recurring waves of infections, leading to fluctuating restrictions. The healthcare system experienced considerable strain, but early intervention, widespread testing, and an extensive vaccination campaign helped maintain a relatively lower mortality rate compared to some other European countries. (*Please refer to the Appendix for a timeline of the Covid 19 measures in Germany for the period March 2020 to June 2022*)

### **Work package 3: Criticality Assessment (Month 5 to 17)**

This work package addressed the first objective: **to analyse the criticality of second- and third-order impacts from disruptions to infrastructure and services on the livelihoods of marginalized groups.** It focused on assessing the cascading effects of COVID-19-related mobility restrictions and infrastructure disruptions to answer the research question: *What are the indirect effects of COVID-19 on the livelihoods of marginalized groups due to disruptions of infrastructure and services?* Using a cascading effects model, the analysis traced how disruptions in one sector triggered broader systemic impacts, amplifying vulnerabilities, affecting livelihoods, and deepening social inequalities.

Our research in Germany focused on examining the interdependencies between mobility and critical infrastructure sectors, specifically healthcare, food and nutrition, social work, education, and childcare (Schnittfinke et al. 2024). These sectors were selected due to their direct impact on daily life and their reliance on physical accessibility, distinguishing them from other critical infrastructures such as water or electricity. Since marginalized communities often have fewer resources and alternative options, disruptions in these sectors were particularly detrimental, further deepening existing inequalities.

#### **Methodology**

To assess the systemic vulnerabilities caused by COVID-19-related mobility restrictions, we adopted a qualitative research approach combining literature research, expert interviews, cascading effects development, and validation workshops.

#### **Literature Review and Expert Interviews**

Our analysis began with a comprehensive literature review to understand existing research on the cascading effects of critical infrastructure disruptions and their disproportionate impact on marginalized communities. To complement these findings, we conducted qualitative expert interviews with professionals across key sectors, including:

- Public transport operators to assess the extent of mobility disruptions and their impact on different population groups
- Public health officials to understand the pandemic's uneven impact on access to healthcare
- Social workers from various fields to gain insights into the challenges faced by marginalized communities, including homeless individuals, people with disabilities, low-income groups, migrants, and elderly individuals

These interviews provided first hand perspectives on the consequences of pandemic-related restrictions, particularly for individuals reliant on public services.

#### **Development of the Cascading Effects Framework**

Building on insights from the literature review and expert interviews, we developed a cascading effects framework to visualize and analyse the complex interdependencies between mobility disruptions and critical infrastructure sectors. The framework identifies:

- The initial dependency of each sector on public transport, analysing how mobility restrictions directly affected infrastructure functionality.
- The ripple effects on employees and service users, illustrating how disrupted transport systems impacted individuals' ability to work and access essential services.
- Interdependencies between sectors, showing how disruptions in one area (e.g., school closures) led to broader consequences in other sectors (e.g., childcare or food security).

This model was refined iteratively to ensure it accurately captured the multi-layered vulnerabilities that emerged during the pandemic.

### **Validation Process**

To validate and refine the cascading effects framework, we conducted expert consultations in the Ruhr region, Germany, (from May to July 2023), as well as in-person workshops in São Paulo, Brazil, (21.09.2023) and Cape Town, South Africa, (28.11.2023). These sessions aimed to assess sectoral dependencies, spatial hotspots of vulnerability, and the broader cascading effects of mobility disruptions.

In São Paulo and Cape Town, we held in-person workshops, where experts collaboratively identified sectoral interdependencies, evaluating how disruptions in mobility affected access to essential services such as healthcare, food provision, and education. Each workshop brought together approximately ten experts from practice, administration, academia, and local NGOs, ensuring diverse perspectives and a comprehensive understanding of systemic dependencies.

In Dortmund, due to scheduling challenges and time constraints of the experts, we opted for a digital validation process instead of an in-person workshop. Experts were provided with a two-week timeframe to review and refine the cascading effect chains on a Miro board, where they could comment, suggest modifications, and add missing interdependencies. Additionally, they received a survey designed to capture potential gaps, missing interconnections, and sectoral dependencies that might not have been fully addressed.

This flexible, asynchronous approach allowed for broader expert participation, ensuring valuable input despite scheduling difficulties. The insights gathered through the digital consultation and surveys in Dortmund were integrated alongside findings from the in-person workshops in São Paulo and Cape Town, resulting in a comprehensive and well-rounded validation of the cascading effects model. *(Please refer to the Appendix for an elaborate structure of the cascading chains)*

### **Summary of Results**

#### **Cascading Effects Across Critical Infrastructure Sectors**

The study revealed that disruptions in critical infrastructure sectors during the COVID-19 pandemic had profound cascading effects, particularly for marginalized communities. While all individuals experienced challenges, those with fewer resources faced disproportionate hardships due to limited alternatives and safety nets (for a detailed look at the cascade effect chains, please see appendix). Key findings across the sectors include:

**Healthcare:** Limited access to medical facilities and resources resulted in delayed treatments and worsened health conditions among marginalized populations. While non-marginalized individuals were also affected, their greater access to private transportation and financial resources helped mitigate some of the adverse effects.

**Food and Nutrition:** Disruptions in supply chains and the closure of food distribution centers significantly impacted access to nutritious food. This exacerbated malnutrition and deepened cycles of food insecurity.

**Social Work:** The shutdown of social work infrastructure, including advice centers and community resources, led to increased social and economic disparities. Vulnerable individuals lost access to crucial support services, making it harder to navigate financial and social challenges.

**Education:** School closures and remote learning challenges disproportionately affected marginalized students, particularly those from migrant backgrounds, who faced language barriers and a lack of digital learning tools. These disruptions widened existing educational inequalities, limiting future opportunities.

**Childcare:** The closure of childcare facilities placed additional burdens on caregivers, particularly single parents and low-income families, disrupting employment and financial stability. Meanwhile, wealthier households were more likely to access private childcare options or work remotely, easing the impact.

### **Impact on Critical Infrastructure Workers**

Beyond the effects on service users, the study also examined the consequences for staff working within these sectors:

- Increased commuting costs and travel times due to reduced public transport availability led to financial strain and work-life imbalances.
- Public transport disruptions forced many workers, especially those in social work and healthcare, to find alternative, often more expensive or time-consuming, commuting options.
- Workforce shortages were exacerbated by COVID-19 exposure risks, resulting in increased workloads, heightened stress, and mental health challenges among critical infrastructure employees.

### **Case Study Insights: Ruhr**

While cascading effects were observed across all three study areas, some challenges were location-specific due to regional conditions. In the Ruhr region, two key findings stood out:

- **Education and Social Services:** School closures had a disproportionate impact on students from migrant backgrounds, as language barriers made remote learning more difficult. Additionally, the closure of social facilities deprived vulnerable individuals of essential support networks, increasing psychological stress and economic hardship. The social work sector struggled to meet rising demands for mental health support, further straining resources.
- **Mobility and Self-Restriction:** Even after lockdown measures were lifted, fear of infection discouraged many individuals from returning to public transport, limiting their ability to access healthcare, social services, and employment. This voluntary self-restriction exacerbated pre-existing inequalities, as those without private transport remained excluded from essential services.

**TAKE AWAY MESSAGE:** the findings highlight how mobility restrictions triggered cascading effects across multiple sectors, reinforcing structural inequalities. These insights provide a foundation for further research and policy recommendations aimed at building more resilient and inclusive infrastructure systems. **Published in:** Schnittfinke et al. 2024.

## **Work Package 4: Mobility Biographies (Month 11 to 29)**

Work Package 4 addressed the objective of exploring **how the COVID-19 pandemic impacted the livelihoods, mobility, and accessibility of marginalized urban populations**. It specifically sought to answer the research question: *What are the direct effects of COVID-19 on the livelihood and mobility of marginalized groups?* The Work Package examined both direct and indirect effects across three time periods: pre-pandemic (2019), during lockdown (2020), and post-pandemic (2023/2024). The data collected through 91 household interviews in the Ruhr Area provided both qualitative and quantitative understanding of changing mobility patterns, access to essential services, and activity participation of various marginalised groups. These findings informed the analysis carried out in Work Package 5.

### **Methodology**

#### **Household Interviews and Mobility Biographies**

**Pilot research and training:** Research on mobility biographies began with a pilot project in February 2023 in Dortmund. As a pre-condition, field researchers were trained on the use of the Maptionnaire software for data collection. Tests were then conducted in various neighbourhoods and social events to understand the receptiveness of the survey and to make any necessary adjustments to the survey. A similar training and pilot project was carried out in March 2023 in Cape Town and in September 2023 in São Paulo. Following the tests, necessary adjustments and translations were made to the survey. In Dortmund, the survey was developed in both German and English languages and in São Paulo, the survey was conducted in Portuguese language. English was sufficient as a language of execution in Cape Town.

**Data Collection:** The research team agreed to define a household as individuals living under the same roof who share the same food and expenses such as rent. Given the varying household sizes across the case cities, it was agreed to cap interviews at a maximum of four household members in order to avoid respondent fatigue and to ensure consistency across all cities. Data collection was conducted between April and August 2023 in Cape Town, focussing on the townships of Gugulethu and Bloekombos. In Dortmund, the data collection began in April 2023, however, due to the summer break and the apprehension of participants to take part in the survey, data collection took longer than anticipated. An invitation by the City of Dortmund to a November 2023 roundtable meeting in Dortmund Nordstadt connected the project with local social service agencies who helped to establish contact with respondents. The interviews in Dortmund were completed in May 2024. Similar challenges of apprehension and mistrust were experienced in São Paulo. To address this, the researchers first held focus group discussions with the residents of Cidade Tiradentes and Região Central to build a rapport before conducting the interviews. The survey was completed in May 2024.

Using narrative biographical interviews, the study documented how households and individuals experienced and adapted to mobility restrictions, service disruptions, and economic changes. The interviews focused on:

- Household demographics and socio-economic status before, during, and after the pandemic
- Access to physical mobility and use of different modes of transportation
- Access to virtual mobility, assessing internet access, digital devices, and the ability to replace physical activities with online alternatives
- Changes in daily activity participation (work, school, daily needs, healthcare, and social networks) over time
- Coping strategies used to manage mobility disruptions and their success or failure

**Participatory Mapping (Maptionnaire):** The household survey data was gathered using the Maptionnaire software which allowed participants to engage in spatial mapping using an interactive map that gathered geospatial data. The teams from the three countries applied a questionnaire (with open and closed questions). The respondents illustrated their mobility patterns and accessibility challenges and further identified:

- Residence location and the places of regular travel.
- Trip purposes, categorized as work, school, daily needs, healthcare, and social network interactions
- Mode of transportation, travel time, and trip frequency for each destination
- Whether activities could be performed online, assessing the extent of digital substitution for physical mobility

**Additional Qualitative Insights:** To capture broader impacts beyond structured mobility-related questions, we asked participants to state the biggest impact of COVID-19 on their lives. This open-ended question allowed us to explore a wider range of personal experiences and to obtain deeper insights into livelihood disruptions, financial struggles, mental health effects, and long-term behavioural changes.

**Analysis:** Data analysis for the mobility biographies was carried out using both a qualitative and quantitative approach. The quantitative approach involved programming using R Software (R Core Team, 2024). The raw data from the household Interviews was transformed to make it easier for subsequent analyses. The qualitative analysis involved systematically analyzing the participants' responses using thematic coding to identify common patterns and variations in the effects of COVID 19 across different groups.

### **Quantitative Approach**

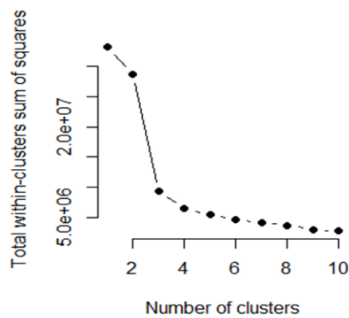
The quantitative analysis entailed a nested approach that involved:

- Geospatial Analysis and Domain Change Measurement
- Cluster Analysis

### **Geospatial Analysis and Domain Change Measurement**

This stage involved assessment of changes over time during the three time periods: T1 - before Covid19; T2 - during Covid19; T3 - after Covid19. Comparative measures such as distance and travel area were used to assess the changes. The distances were calculated between homes and various livelihood activities (work, school, shopping for daily needs, health, social) for each period and person. This analysis was crucial in understanding how people's mobility and activities changed over the different periods of the pandemic and within space. In addition to the distances, the area for each household within the three periods was calculated. The area was calculated using the Convex Hull technique using the sf package (Pebesma, 2018) in R. The area was the size of the travel radius of each household within space for the various livelihood activities (work, school, shopping for daily needs, health, social).

## Cluster Analysis



The cluster analysis technique was applied to identify groups with similar characteristics. The variables selected for the cluster analysis were similar across the cities. They included the data calculated Geospatial Analysis and Domain Change Measurement and the financial situation of the households in T1, T2 and T3. The results revealed varying cluster groups across the cities. The number of clusters was chosen based on the Elbow Method, creating a graph showing the number

Figure 4: Elbow method in Cluster Analysis

of clusters on the X axis and the within-cluster-sum-of-square (WCSS) values on the Y axis (Figure 4). With this, five clusters were identified for Dortmund while four clusters emerged in São Paulo, and three in Cape Town.

## Qualitative Approach

The quantitative approach included an analysis of the respondent's qualitative insights and entailed a Thematic Analysis and identification of Illustrative Cases.

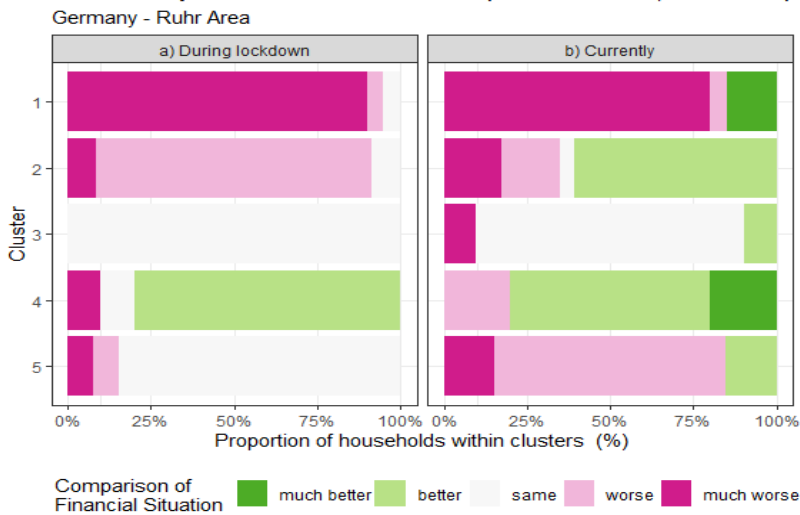
**Thematic Analysis:** The Thematic Analysis involved an iterative method that aimed to extract key meanings and patterns from the qualitative data. The information emerging from the data was firstly categorised into specific sub-themes based on the information provided by the respondents. A second iteration involved grouping similar sub-themes into broader categories to identify similarities or differences across the research areas. A third step involved synthesizing the themes into narratives that communicated the findings from the analysis in an engaging and understandable way. This analysis enabled a deeper understanding of the experiences and perceptions of marginalised groups in relation to the pandemic and its impact on their livelihoods.

**Illustrative Cases:** The results of the quantitative approach, and the thematic analysis were integrated to identify illustrative cases. Since the data collected was not representative of the entire population, specific households who fit the profile of the clusters and the thematic analysis were selected as concrete examples of the research findings. These illustrative cases will also be used to explain the Livelihood Framework (WP6) according to the Workflow diagram (Figure 1), which is particularly relevant for contextualising the experiences of marginalised groups.

## Summary of Results

### Cluster Analysis

Financial Situation: The study revealed differences across the marginalised groups in terms of the financial situation and the variation in the distances travelled before, during and after the pandemic. The results varied across the various clusters.



A comparative analysis of the household financial situations across different clusters in Dortmund highlighted variations during the lockdown and in the current period. The financial status was categorized into five levels: much better (dark green), better (light green), same (white), worse (light pink), and much worse (dark pink).

Figure 5: Financial Situation of Households Before, During, and After the Pandemic in the Ruhr Area

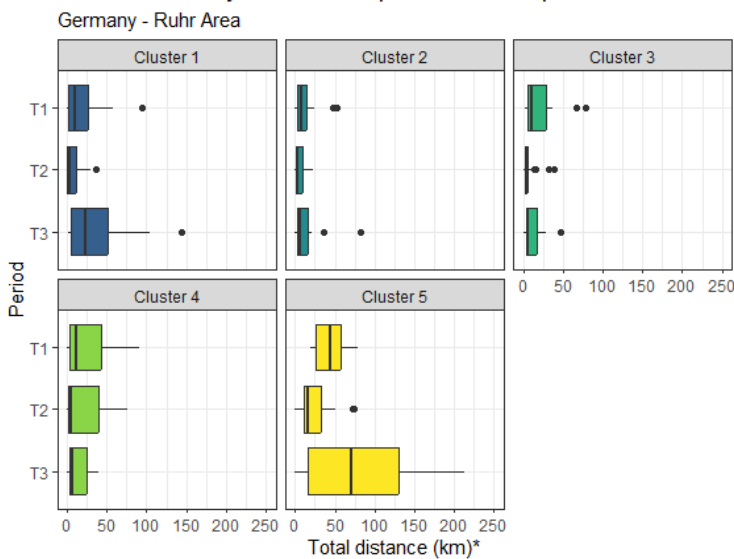
**During lockdown:** A large proportion of households across all clusters experienced a financial decline (**worse/much worse**). Cluster 1 and Cluster 2 were particularly affected, with a majority reporting that their financial situation was **much worse**. Only Cluster 4 had a notable proportion of households reporting **better** financial conditions, suggesting possible resilience or financial stability in this group. Clusters 3 and 5 displayed a mix of responses, with some households maintaining financial stability (**same**) and others experiencing worsening financial conditions.

**Current Situation:** The period after the pandemic indicates that financial recovery appears to be underway, but disparities remain across clusters. Clusters 1 and 2 still show a significant proportion of households reporting worse financial conditions, though a small share have seen improvements. Cluster 4 remains the most financially stable, with a continued higher proportion reporting better or much better financial status. Cluster 3 shows that the financial situation remained the same for most of the households with a few shifting towards financial improvements and another smaller share shifting towards a much worse financial situation. In Cluster 5, most of the households appear to be in a worse financial situation than during the pandemic with a very small share moving to a better financial situation.

### General Interpretation

- a.) **Financial recovery is uneven**, with some clusters still struggling while others have returned to or exceeded pre-pandemic financial conditions.
- b.) **The pandemic had a disproportionate impact on different household clusters**, with Clusters 1 and 2 being the hardest hit during the hard lockdown. Cluster 4 appeared to have the most financially resilient households, possibly due to stable income sources, higher savings, or social support from the government.

**Distance Travelled:** The total distances in **Cluster 1** reduced significantly during the pandemic (T2) indicating restricted mobility. In the current situation, distances increased



slightly than pre-pandemic levels. In **Cluster 2**, similar observations as in Cluster 1 indicate limited movement during the lockdown. The current situation shows a partial rebound but travel distances are still lower than T1. Households in **Cluster 3** indicated higher travel distances before the pandemic but a major drop in mobility during the pandemic. T3 shows some recovery, but distances remain rather lower than T1.

Figure 6: Total distances travelled by households in different clusters

before, during, and after the pandemic.

**Cluster 4** consistently exhibits lower travel distances across all periods. There is some reduction in travel during the lockdown but overall, mobility patterns appear less disrupted compared to other clusters. T3 shows a slight increase from T2, but mobility remains constrained. The fifth Cluster, **Cluster 5** demonstrates a large variation in total distance travelled across periods. Some households travelled much longer distances before the pandemic but a drastic reduction was witnessed during the lockdown. T3 indicates that households in this cluster have returned to pre-pandemic travel behaviour and even slightly larger distances travelled more than other clusters.

### General Interpretation

a.) **Recovery is uneven:** Clusters 1 and 3 are seeing a return to higher mobility after the pandemic, while Clusters 2, 3 and 4 still show reduced distances. This also means that long-term mobility behaviour changes are evident since some households may have permanently altered their commuting patterns, adjusted their lifestyles or travel less due to economic factors.

- Financial impacts and mobility changes are somewhat interconnected. Clusters that experienced a sharp decline in financial conditions (Figure 3) also adjusted their mobility patterns (Figure 4).
- Cluster 4 emerges as the most resilient in both finances and mobility, with stable travel distances and financial conditions.
- Some clusters have recovered financially but not in mobility (e.g., Cluster 2), while others have resumed travel patterns but still struggle financially (e.g., Cluster 1 and Cluster 5).

### Thematic Analysis

The thematic analysis was conducted on the household interviews in Dortmund, resulting in 185 coded responses. The goal was to better understand the lived experiences of marginalized households before, during, and after the COVID-19 pandemic. The analysis constituted an iterative qualitative method to extract patterns, meanings, and thematic structures from the data.

The process involved several stages. First, familiarisation with the data was carried out by reading through all open-ended comments to gain an initial understanding of the respondents'

perspectives. Next, preliminary themes were identified during the initial coding phase, based on the frequency and repetition of similar concerns or experiences. These were then grouped into broader, overarching themes that captured shared patterns across households. A cross-city workshop was held to compare and refine the thematic categories from each case study area, resulting in a set of commonly agreed-upon themes with clearly defined labels. The final step involved interpretive synthesis and storytelling, where the coded themes were transformed into narrative accounts that could meaningfully convey the findings and their implications.

In Dortmund, six main thematic categories and sixteen sub-themes emerged through this process. These were derived from responses to open-ended questions 44 and 45 of the household questionnaire, which invited participants to reflect on the most significant impacts of COVID-19 on their lives. The responses were also cross-analysed with findings from the other study sites for comparative insight. A particularly prominent cross-cutting theme was emotional and mental health, which was closely tied to disruptions in social connection, household stability, economic security, and trust in institutions.

**Emotional and Mental Health:** Emotional and mental well-being emerged as one of the most pressing concerns among respondents. Many described feelings of anxiety, aggression, depression, loneliness, grief, stress, and sadness. These emotional responses were often related to prolonged isolation, fear of infection, and the uncertainty of the evolving pandemic situation. For some, emotional distress was also triggered by the perceived inconsistency or severity of government policies. While a few participants reported moments of gratitude and introspection, the overall tone revealed a deep strain on psychological resilience and social belonging. Reports of loneliness were often connected to a lack of social contact and the closure of spaces like universities, cafés, or clubs.

**Perceptions of Government Policies:** A significant portion of respondents expressed dissatisfaction or outright mistrust toward the government's policy response. This included negative reactions to mask mandates and vaccination requirements, which some viewed as infringements on personal freedoms. While a few respondents saw such measures as necessary but inconvenient, others perceived them as unjustified and authoritarian. These sentiments highlight a fracture in trust and compliance that shaped people's experiences beyond the pandemic's material effects.

**Finances and Job Security:** Many households were financially affected by the pandemic. Respondents frequently cited job losses, business closures, reduced income, rising prices, and mounting personal debt. These financial pressures intensified feelings of uncertainty and vulnerability, particularly among those already in precarious employment or dependent on support services. Financial strain was not only material but also emotional, with several participants linking their economic hardship to experiences of depression and hopelessness.

**Household Dynamics:** Household relationships were significantly impacted by the pandemic. With schools and kindergartens closed and many people working from home, families had to renegotiate domestic roles, often under great stress. Mothers in particular bore the brunt of increased caregiving responsibilities. Remote learning presented further challenges, not only for children's education but also for the emotional balance of the household. Family estrangement and conflict were mentioned as unintended side effects of lockdown-induced proximity or separation.

**Access to Services and Digital Divide:** The transition to digital services during the pandemic created a significant barrier for many marginalized households. Respondents without adequate internet access, digital devices, or digital literacy struggled to access healthcare,

administrative services, or educational support. Non-German-speaking individuals faced additional obstacles, such as the lack of translation services during medical or bureaucratic appointments. Several respondents noted that phone consultations were less effective than in-person interactions and described how the move online contributed to a sense of exclusion.

**Mobility and Infrastructure Limitations:** Mobility challenges compounded issues of access and well-being. Reduced public transport options and the lack of safe alternatives, such as reliable cycling infrastructure, limited people’s ability to attend appointments, run errands, or maintain social connections. Respondents described navigating environments that felt unsafe or inaccessible and emphasized that these mobility restrictions persisted beyond the lockdown period, continuing to affect daily routines and participation in public life.

**TAKE AWAY MESSAGE:** The findings highlight that both financial and mobility-related impacts of the COVID-19 pandemic were uneven across household clusters. Travel distances dropped across all clusters during the lockdown but recovery diverged in ways closely linked to household finances. Some households such as those in Cluster 1 and 5 resumed physical travel while experiencing ongoing financial struggles, while others, such as those in Cluster 2 experienced financial improvement but maintained lower physical mobility, relying in part on virtual access. Financially stable households such as in Cluster 4 continued to travel less after the pandemic. These findings are nuanced by the thematic analysis that revealed that the pandemic’s effects unfolded across interlinked emotional, economic, and spatial dimensions, including social disconnection, digital exclusion, strained household relationships along with financial insecurities and reduced mobility. At the same time, narratives highlight the importance of trust, community, and adaptability in navigating crisis conditions.

### **Work Package 5: Accessibility Mapping (Month 15 to 36)**

Work Package 5 was nested within WP4 and assessed households’ accessibility and mobility. Guided by WP4 findings, it addressed the research questions: *How has COVID-19 changed the livelihoods and mobility of marginalized groups?* and *What accessibility opportunities and challenges have resulted from COVID-19 in terms of physical and virtual access?* In line with the third objective: **understanding the changing roles of virtual versus physical access**, the study examined movement constraints and access to essential activities among selected households in WP4 clusters. These formed the Illustrative Cases, with detailed analyses in the Annex under *Livelihood Profiles*.

#### **Cluster One: Critically Impacted by the Pandemic Illustrative Case**

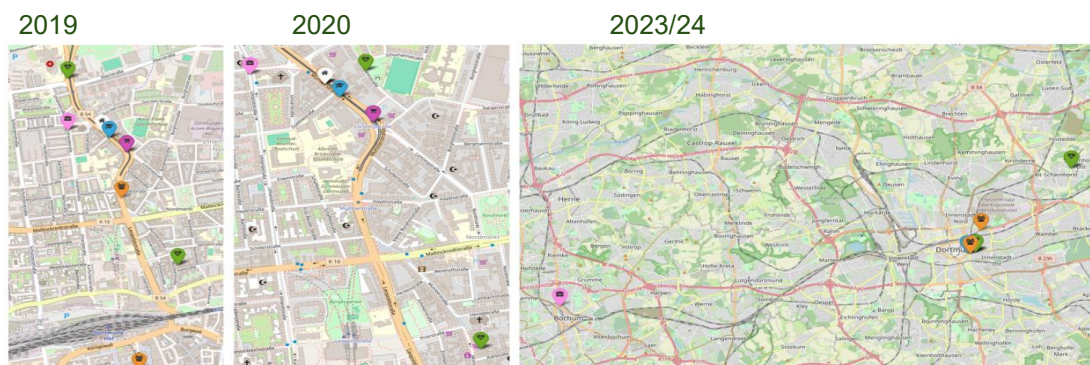


Figure 7: Spatial Representation of Movement Patterns and Activity Locations (2019–2024)

This four-member household, a couple and their two school-aged children, faced significant disruption during the COVID-19 pandemic. The father, previously self-employed, lost his business and clients during the lockdown, leading to emotional distress and financial

instability. By 2023, he transitioned to employment in Bochum, though at a lower income. The family now earns approximately €1,500 monthly.

The pandemic exposed their limited access to virtual services: unreliable internet and lack of digital literacy severely restricted their engagement with online platforms, including education and social services. While the children participated in some online learning, overall virtual engagement remained minimal. This digital exclusion deepened other hardships, including job loss, lack of heating, and mental health strain.

Since the pandemic, the father travels more frequently to sustain the household. To be able to recover, the needs include affordable and stable internet, digital literacy support, financial assistance to restart the business, mental health services, and housing improvements.

### **Cluster Two: Better than Pre-pandemic times Illustrative Case**

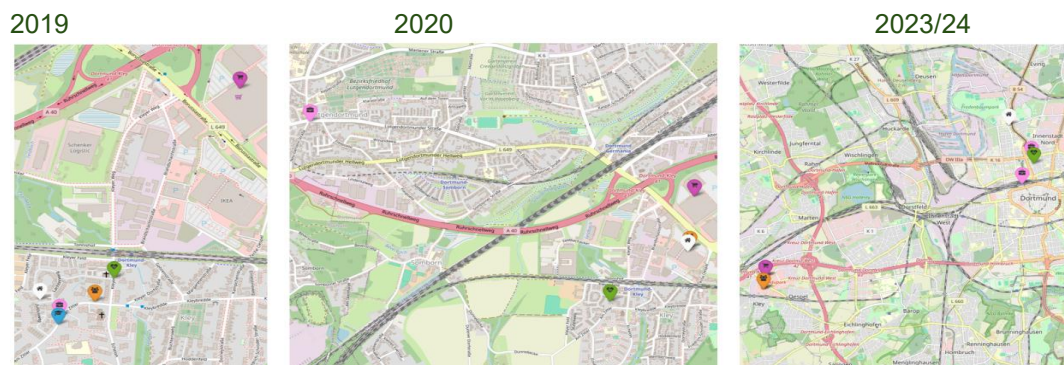
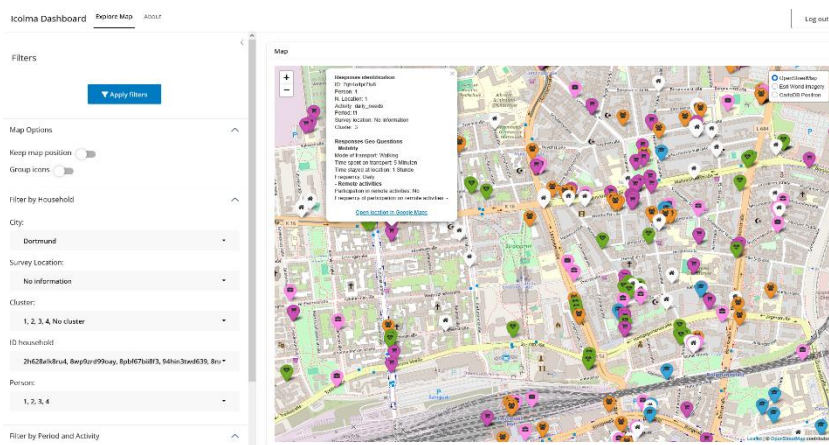


Figure 8: Spatial Representation of Movement Patterns and Activity Locations (2019–2024)

This household, comprising a couple and their newborn daughter, faced compounded vulnerabilities during the COVID-19 pandemic. The respondent, a Moroccan woman who migrated in 2018, experienced an interruption in her education and a period of unemployment in 2020, while caring for a newborn. Despite financial challenges and limited living space, she managed to continue her education through online learning, demonstrating strong virtual engagement and resilience. Her partner, a long-term resident of Germany, also holds a bachelor's degree, and the household earns approximately €2,500 per month.

The pandemic intensified emotional and spatial stress, with caregiving responsibilities, remote learning, and fear of illness contributing to psychological strain. Communication barriers, particularly related to limited German proficiency, further restricted access to support services and deepened feelings of isolation.

While physical mobility was constrained, virtual learning emerged as a key coping strategy, enabling educational continuity. The household's recovery needs include improved access to adult language programs, tailored employment support, affordable housing, mental health services, and community integration initiatives to reduce isolation and enhance resilience.



In addition to these assessments, the research team developed a dynamic, visual, and interactive dashboard. This dashboard enabled us to visualise and compare the changes in activity domains before, during and after the pandemic.

Figure 9: Interactive Dashboard for changes in activity domains and distance travelled before, during and after the pandemic

**TAKE AWAY MESSAGE:** The in-depth qualitative analysis further highlights the relationship between financial status and mobility across clusters. On one hand, households that lost jobs or faced financial instability travelled more to reach new opportunities as an active strategy to cope with the financial shock. On the other hand, households that maintained stable employment or were able to transition their work or education online travelled less, relying on virtual means to sustain their financial and educational activities. However, the benefits of virtual access were uneven. While some households were able to take advantage of online platforms to maintain their income and continue with education, others, especially those with businesses that should not be moved online or lacking stable internet and digital literacy, remained excluded from digital opportunities. This shows the importance as well as the limits of virtual access where it offered stability and continuity for some who could move their work online yet could not fully substitute the physical mobility required by those whose work could not be shifted online.

### Work Package 6: Comparative analysis and livelihood framework (Month 30 to 36)

Work Package 6 elaborated the findings from the three case study cities and applied the livelihood framework as an analytical tool to structure the impacts of COVID-19 along key livelihood assets - such as human, social, financial, physical, and digital capital. According to Chambers and Conway (1992), a livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is deemed sustainable when it can cope with and recover from stresses and shocks and maintain or enhance capabilities, assets, and activities, both now and in the future. The livelihoods approach is based on the way the poor and vulnerable live their lives, and the importance of structural and institutional issues. The livelihoods approach helps organize factors that constrain or enhance livelihood opportunities and shows how they relate to one another; as such, it is more than an analytical framework. Thus, it serves well into our fourth objective which was **to structure the impacts of COVID-19 along livelihood assets and to recommend measures and policy responses that promote equitable accessibility and strengthen the resilience of marginalized groups**. This WP sought to answer the research question: *How can the resilience of marginalized groups be supported and improved through equitable accessibility, including virtual access?* The livelihoods approach was particularly valuable in capturing the complex direct and indirect impacts of the restrictions during the pandemic. In this research, the COVID-19 restrictions served as an entry point to examine

how households coped with and recovered from stresses and shocks and to identify recovery needs.

### **Methodology**

A livelihood approach places households and their members at the centre of analysis and decision making. Knowledge is needed about the situation of and strategies adopted by poor households, in relation to both their characteristics and external opportunities and constraints. The methodological approach in such data collection and analysis is contextual and participatory to capture a social phenomenon within its social, economic and cultural context (Booth et al, 1998).

Livelihood researchers group the five capitals as follows (De Haan et al., 2002):

**human capital** (Skills; entrepreneurial ability; education level; ability to work; security of employment; income earner dependency ratio),

**social** (Exchanges of goods and services; assistance to or from extended family networks in rural areas, other urban areas or overseas; membership in community groups; nature of interactions with other households; level of social isolation) and

**economic, including physical and financial**) (Land; home ownership; transport; equipment; shops; market stalls; household water and sanitation facilities; savings; salary; money from income generating activities; remittances; access to credit).

**Natural capitals** are not related to a single household in urban areas but understood on the community or political level. The natural capital is thus on the same level as organisations, infrastructure, cultural environment, political environment and economic environment. natural environment (Location of community with respect to topography –e.g. flood prone areas; slopes and hillsides; environmental issues: contaminated areas, dump sites; access to green space; traffic and safety.)

ICOLMA started understanding COVID-19 with its impact on health, education, income generation activities, mobility restriction as well as lock down policies **as external shock on livelihoods** and investigated by secondary data socio-economy figures and household interviews the **situation before, during and after the pandemic**. Results will be thus a **threefold livelihood diagram** for illustrative cases within each cluster displaying the three time periods (before, during and after the pandemic) and whether the household was able to recover after the pandemic shock to the status before or not. Based on the 277 household interviews in the three case study cities, covering both quantitative and qualitative data on the household level as income generating activities, mobility patterns, services available and used for the three time periods (see 4.1.1.), a cluster analysis has been conducted to identify subgroups and develop household narratives (see 4.3.1.). The aim of the livelihood analysis was to find out how households coped with the challenges of the pandemic. Based on that, ICOLMA picked illustrative cases (see section 5) for a deeper analysis to understand their coping mechanisms and recovery needs. These were selected as concrete examples for the livelihood framework and were used for the comparative analysis.

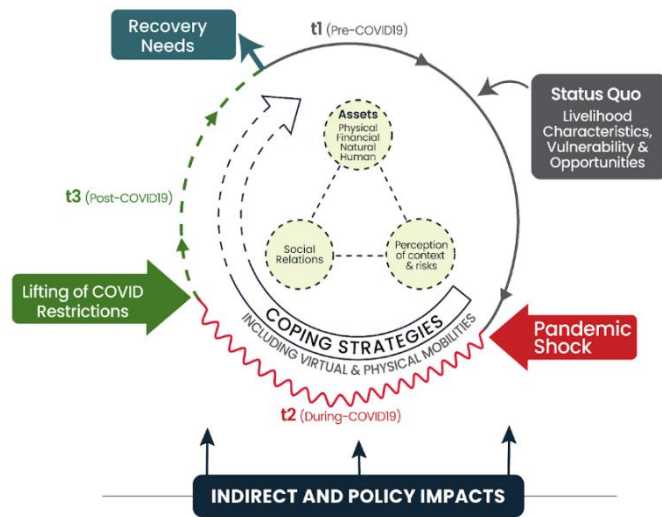


Figure 10: Adapted Livelihood Framework

Figure 10 shows the livelihood framework as a cyclical process. T1 reflects the pre-pandemic context (status quo), using the concept of ‘livelihood context’ (Natarajan et al., 2022) to describe the broader environment shaping livelihoods, while highlighting opportunities alongside vulnerabilities. T2 captures the pandemic as a sudden shock, with uneven coping strategies such as physical (job changes, reduced travel) and virtual (remote work, education) limited by barriers such as digital access.

T3 marks the recovery phase, focusing on rebuilding resilient, inclusive livelihoods and framing it as an opportunity for transformation rather than a return to normal.

### Comparative Analysis and Summary of Findings

To illustrate the application of livelihood changes within marginalised households, we analysed illustrative cases from each cluster through the lens of coping strategies (including both physical and virtual mobilities) and recovery needs identifying how households rebuilt their livelihoods after the pandemic. We compared across Sao Paulo, Cape Town and the Ruhr area to understand the diversity of recovery trajectories but also common coping strategies that cut across different contexts. For capacity reasons, we provide a comparison between the Ruhr area and Cape Town here.

#### Households severely impacted by the pandemic

In Cape Town and Dortmund, households most severely impacted by the pandemic revealed how shocks manifested differently across contexts yet produced overlapping vulnerabilities. In Cape Town, for example, a female-headed household lost its primary source of income, forcing the family to rely on child grants and external kinship support. In Dortmund, a father similarly lost his business, plunging the family into economic insecurity. Both households experienced the abrupt economic impact on their livelihoods and the lack of long-term stability.

Mobility emerged as a coping mechanism for both households due to financial pressures. In Cape Town, the household responded to the financial strain by sending one child to live with relatives in rural areas to reduce immediate household expenses. Simultaneously the household relocated from one informal settlement (Bloekombos) to another (“Covid City”) when their income could no longer cover housing costs. In Dortmund, the household was confronted with unstable housing conditions and digital exclusion which limited their ability to transition work online. They resorted to relocation as a survival strategy and moved to the neighbouring city (Bochum) in search of employment opportunities. In both cases, mobility was necessary to cope with the financial strain.

Recovery needs emerging from these comparisons are:

- Financial support and income diversification (e.g. through possibility of moving work online) was critical in both contexts
- Housing stability, to reduce displacement pressures for the case of Cape Town

- Educational support for children, specifically in Cape Town and access to stable online learning in Dortmund.
- Digital connectivity and literacy to enable households to tap into online opportunities.

#### Households improved through change and sustained over time

Despite distinct contextual differences, households in both Dortmund and Cape Town coped with the pandemic through reconfiguring family arrangements and pooling resources, which helped to mitigate financial and emotional pressures. In Dortmund, a mother and her adult son began living together during the pandemic. This strengthened their emotional support but also improved the household's financial stability. The mother maintained steady employment while the son continued schooling despite challenges transitioning to e-learning. In Cape Town, a young man in Gugulethu lost his mother to COVID-19 but his household of five sustained itself through collective resources that included the cousin's income, his own freelance work and an uncle's pension grant.

While vulnerabilities emerged in different forms, family ties provided stability in both contexts. In Dortmund, the main emotional stressors such as social distancing, distance from extended family and the strain of digital transitions were cushioned by the mother and son living together. In Cape Town, family members pooled resources to cope with financial strain. In both cases, resilience was built through kinship, shared income and emotional interdependence.

Recovery needs emerging from these comparisons are:

- Tailored support for digital transitions especially for students adapting to online learning in the case of Dortmund.
- Sustained and reliable social protection measures such as pension grants for the case of Cape Town and income-stability measures for working families in the case of Dortmund.
- Recognition of family and kinship networks as buffers against shocks and social policies that enable multi-generational or shared living arrangements.

**TAKE AWAY MESSAGE:** Despite extreme social and spatial differences across the Ruhr Area, Cape Town and Sao Paulo, the findings reveal convergence of coping strategies across marginalised households. Mobility, whether through physical relocation in search of new opportunities or reconfiguring household arrangements such as additional household members who moved back home during the lockdown, emerged as a means of responding to financial pressures. At the same time, virtual access played a significant role. While some households sustained or even improved their livelihoods by moving work and learning online, others were excluded due to unstable internet and low digital literacy. Taken together, the cases demonstrate how mobility and virtual access intersected as strategies for coping with the impacts of the pandemic with recovery shaped by the availability of social and kinship support and digital opportunities across contexts. Programs targeted in assisting marginalised households to access and use digital infrastructure will be necessary to strengthen their resilience in the event of future pandemic or drastic livelihood disruptions.

## **Work Package 7: Summary or research findings and Dissemination**

### **Animation of Project findings**

Title: Impact of Covid 19 on the Livelihood, Mobility and Accessibility of Marginalized Groups (ICOLMA) in Ruhr Area, Cape Town, São Paulo

Developer: Green House Cartoons, South Africa

## Conference Presentations

### **AESOP Conference (11–15 July 2023, Łódź, Poland)**

Presentation Title: The Overlooked: Impacts of COVID-19 Measures on the Livelihoods, Mobility and Accessibility of Marginalised Groups

Presenter: Tanja Schnittfinke (TU Dortmund)

### **T-AP RRR Networking Event (11–12 October 2023, Online)**

Presentation Title: Initial Findings from the ICOLMA Project

Presenter: Prof. Stefan Greiving (TU Dortmund)

### **BMBF/DLR Conference (16–17 November 2023, Bonn, Germany)**

Presentation Title: Gesellschaftliche Auswirkungen der Corona-Pandemie: Perspektiven marginalisierter Gruppen

Presenters: Prof. Stefan Greiving and Dr.-Ing. Dorcas Nthoki Nyamai (TU Dortmund)

### **Africa Transport Conference (5–7 March 2024, Cape Town, South Africa)**

Presentation Title: Long-Term Travel Behaviour Impacts of Covid-19 on Marginalised Households in Cape Town

Presenters: Dr. Bradley Rink and Mojalefa Patrick (University of the Western Cape)

### **European Sociology Conference (27–30 August 2024, Porto, Portugal)**

Presentation 1: Exploring the Impacts of Virtual Access on the Mobility and Livelihoods of Marginalized Groups: A Comparative Study in Dortmund, São Paulo, and Cape Town

Presenter: Prof. Dr. Sophie Schramm (TU Dortmund)

Presentation 2: Navigating Disruption: Unravelling the Cascading Effects of COVID-19's Impact on Marginalized Communities through Public Transport in South Africa, Brazil, and Germany

Presenter: Tanja Schnittfinke (TU Dortmund)

### **Latin R Conference – Conferencia Latinoamericana sobre Uso de R en Investigación + Desarrollo (18–22 November 2024, Online)**

Presentation Title: Using R to Clean Data from A Map-Based Survey: Challenges and Lessons Learned

Presenter: Beatriz Milz (Federal University of ABC, São Paulo)

### **Biannual Dortmund Conference (DOKORP), 5-7 February 2025, TU Dortmund University**

The ICOLMA team hosted a dedicated panel under the theme *Planning in Times of Multiple Crises*. The following papers were submitted for presentation:

Presentation Title: Using a map-based survey tool to collect data about the impacts of COVID-19 on the mobility of marginalized groups: challenges and lessons from a three-country project

Presenter: Beatriz Milz (Federal University of ABC, São Paulo)

Presentation Title: Strategy for the ICOLMA project interviews on mobility and livelihoods and the COVID-19 pandemic in the city of São Paulo

Presenter: Prof. Sandra Momm

Presentation Title: Cascading Effects on Critical Infrastructure: Impacts on Marginalized Communities in South Africa, Brazil, and Germany

Presenter: Tanja Schnittfinke

Presentation Title: Exploring the Impacts of Virtual Access on the Mobility and Livelihoods of Marginalized Groups: A Comparative Study in Dortmund, São Paulo, and Cape Town

Presenter: Prof. Sophie Schramm

Presentation Title: Strategies and Methods for Comparing the Impact of the COVID-19 Pandemic on Planning and Spatial Dynamics: The ICOLMA Project in São Paulo, Cape Town, and the Ruhr Area

Presenter: Prof. Sandra Momm

Presentation Title: Long-Term Impacts of COVID-19 on the Livelihoods and Mobility of Marginalised Households in Cape Town

Presenter: Mojalefa Makitle

### **T-AP RRR End of Project Conference (15–16 May 2025, Online)**

Presentation Title: Impact of Covid 19 on the Livelihood, Mobility and Accessibility of Marginalized Groups (ICOLMA) in Ruhr Area, Cape Town, São Paulo

Presenter: Prof. Sophie Schramm (TU Dortmund)

### **Planned Publications**

- Schnittfinke, T. (2025). Cascading Effects Analysis: Methodological Reflections for Managing Compound Urban Crises. *Land. [in submission process]*
- Livelihood Assessment and Illustrative Cases: *Target Journal: World Development*
- Travel Behaviour and Activity Domains: *Target Journal: Journal of Travel Behaviour and Society*
- Exploring impacts of virtual access on mobility of marginalised groups: A Comparative study of Dortmund, Cape Town and Sao Paulo: *Target Journal: Cities*
- Comparative Analysis: Methods and Outcomes: *Target Journal: Urban Studies*

**Special Issue:** “Reflections on the impact of COVID-19 on the livelihoods, mobility, and accessibility of marginalized groups in São Paulo, Cape Town, and the Ruhr region” in *Diálogos Socioambientais* (publication planned in November 2025). Contributions with TU Dortmund:

Paper Title: Research Across Borders: Our Journey as Early Career Researchers in a Transnational Project (Authors: Dorcas Nthoki Nyamai; AnaLia Lionel)

Paper Title: Reframing the Sustainable Livelihoods Framework in Urban Crisis Contexts: Mobility, health, natural capital and the impacts of the COVID-19 pandemic in São Paulo

Paper Title: ICOLMA in the Ruhr region – findings and reflections (Sophie Schramm)

Paper Title: Criticality Analysis: A tool for a world in disruption (Lyvia Nascimento, Tanja Schnittfinke)

Paper Title: Fieldwork and Thematic Analysis in the ICOLMA Project: Lessons and Strategies in the Application of the Maptionnaire Questionnaire (Letícia Vella, Mojalefa Makitle, Tanja Schnittfinke, Beatriz Milz, Gabriel Machado)

Paper Title: Forest Play (Sophie Schramm)

### **Stakeholder Engagement**

#### **Consortium Workshops:**

- First Consortium Workshop (June 8th to 9th, 2022)
- Second Consortium Workshop (30th Nov to 1st Dec 2022)
- Third Consortium Workshop (March 29th to April 1st, 2023)
- Fourth Consortium Workshop (26th Feb to 27th Feb 2024)
- Fifth Consortium Workshop (25th Nov to 29th Nov 2024)

**Validation Workshops:** To verify the validity and reliability of the results from cascading effects in WP3, validation workshops were conducted in each of the three case study areas:

- 4<sup>th</sup> to 15<sup>th</sup> September 2023, Dortmund, Germany
- 21<sup>st</sup> September 2023, São Paulo, Brazil
- 28<sup>th</sup> November 2023, Cape Town, South Africa

The workshop participants constituted experts from various sectors that constituted academia, practice, administration, and non-governmental organizations. The format in Dortmund involved an online survey with the option to work on a collaborative whiteboard

#### **Planned Meeting with the City of Dortmund:**

TU Dortmund University will host a stakeholder meeting with representatives from the City of Dortmund on **22nd September 2025**. The meeting will serve as an opportunity to present key findings from the ICOLMA project and explore how the insights can inform local planning and policy responses, particularly in light of future disruptions.

## 2. Key items of the numerical evidence

<b>Kostenart</b>	<b>Ursprünglicher Gesamtfinanzierungsplan</b>	<b>Verausgabt zu Projektende</b>
Beschäftigte E12-E15 (0812)	225.190,36	227.215,84
Beschäftigungsentgelte – Hilfskräfte (0822)	3.800,00	4.137,35
Sonstige Verwaltungsausgaben (0843)		
Reisekosten (0846)	17.300,00	17.264,38
Projektpauschale – PP (0865)	49.258,07	49.258,07
<b>Bewilligte Summe inkl. PP</b>	<b>295.548,43</b>	
<b>Gesamtkosten</b>		<b>297.875,64</b>

## 3. Necessity and appropriateness of the work

The research followed the proposal work plan and its planned expenditures. However, there were some shifts in the order and scope necessary and delays occurred due to third party involvement and dependencies, specifically in the data collection and analysis phase. The research objectives are still valid and relevant.

## 4. Benefits and usability of the results

There are no plans for direct economic exploitation of ICOLMA results. Findings will be made publicly available through online platforms, journals, and other publications, and incorporated into professional, public, and political discussions on COVID-19. TU Dortmund engaged with city representatives, leading to collaborations with the Youth Affairs Department, the elderly services department, and the Welfare organisation. Results will be shared in academic outlets and presented to city administrations and social service agencies on 22 September 2025. The exploitation plan has been implemented as proposed, with no changes required. No inventions or intellectual property rights have been registered.

## 5. Progress in other areas

During the regular review of scientific publications, no R&D results could be identified that would necessitate adjustments in the implementation of the sub-project listed here. The knowledge-based solutions envisaged in the project are still of great relevance, topicality and innovation.

## 6. Publications from the ICOLMA project

Schnittfinke, T.; Greiving, S.; Nyamai, D. N.; Scholz, W.; Schramm, S.; Behrens, R.; Zuidgeest, M.; Rink, B.; Momm, S.; Travassos, L.; Brauer, B.; Fischer, L. Criticality assessment and cascading effects: impacts of COVID-19 disruptions in public transport on marginalized groups in Dortmund, Germany, São Paulo, Brazil, and Cape Town, South Africa. *J. Surveill. Secur. Saf.* **2024**, *5*, 140-59. <http://dx.doi.org/10.20517/jsss.2024.11>

Rink, B., Makitle, M., Mosikare, M., Behrens, R., Zuidgeest, M., Schramm, S. Nyamai, D., Greiving, S., Schnittfinke, T., Scholz, W. and Momm, S., Travassos, L., (2025). Long-term travel behaviour impacts of Covid-19 on marginalised households in Cape Town. *Transportation Research Procedia*, *89*, 499-510. <https://doi.org/10.1016/j.trpro.2025.05.077>

## PART III: PERFORMANCE REVIEW REPORT

## **1. Contribution of the result to the funding policy objectives**

Urban infrastructure studies have recently considered dynamics of change with a focus on long-term governance changes or everyday appropriations by users and the impacts of these changes on urban social and spatial inclusion. However, the “multiple temporalities” of urban infrastructure systems, and especially the impact of sudden disruptions of these systems and the ways urban actors deal with them over time have not been researched systematically to date in the field of urban infrastructure studies. Critical infrastructure studies in turn have focused on sudden disruptions – like mobility changes caused by the current pandemic – and their impacts on interconnected “systems of systems”. However, this research field has to date often remained oriented toward systems and not taken a spatial perspective on the uneven impacts of such systemic interruptions on livelihoods and accessibility of city inhabitants, and especially marginalised groups. Our research project addresses this gap by bringing together a consideration of urban systems and their criticality with a focus on the livelihoods and mobilities of marginalised groups. This new perspective will enable the project to define recommendations for policies and other measures to support the resilience of marginalised groups in pandemic times. These recommendations focus on the livelihoods of particularly vulnerable groups and are at the same time informed by an assessment of the criticality of urban mobility systems - thus they are geared towards fostering inclusiveness and a more sustainable society. Furthermore, by comparatively studying the impacts of COVID19 on marginalised groups, we provide extremely rich knowledge on inequalities and vulnerabilities and the ways in which different marginalised groups have been able to cope with them and the support they will need in order to cope. Ultimately, the project makes the voices of marginalized groups heard and thereby goes beyond statistical data while at the same time using digital tools to map and trace the ways in which the pandemic has impacted mobilities and livelihoods. This will make our analyses and recommendations plausible for a wide audience beyond academia. Therefore, ICOLMA addresses all five goals of the call by

- (i) reducing inequalities and vulnerabilities of marginalised groups
- (ii) building a more resilient, inclusive and sustainable society by analysis the impacts of the COVID-19 restrictions;
- (iii) fostering democratic governance and political participation by household interviews and giving a voice to marginalised groups
- (iv) advancing responsible and inclusive digital innovation by looking for entry points and obstacles of digital accessibility of marginalised groups;
- (v) ensuring effective and accurate communication and media by dissemination the research results beyond the academia.

## **2. Scientific and technical results, secondary results and experience**

The first Africa Transport Research Conference (ATRC) was held in March 2024 at the University of Cape Town where the ICOLMA Team will present the findings of the study on the topic: “Long-term Travel Behaviour Impacts of Covid-19 on Marginalised Households in Cape Town”

The ICOLMA Team also presented the research findings at the European Sociological Association Conference to be held in Porto from 27th to 30th August 2024. Two papers will be presented on the topic of “Navigating Disruption: Unraveling the Cascading Effects of COVID-19’s Impact on Marginalized Communities through Public Transport in South Africa, Brazil and Germany” and “Exploring the Impacts of Virtual Access on the Mobility and

Livelihoods of Marginalized Groups: A Comparative Study in Dortmund, São Paulo, and Cape Town”

The research team disseminated the findings of the study in the biennial DOKORP conference held at the TU Dortmund in February 2025 under the title “Planning in times of multiple crises”.

On September 22, 2025, the results of ICOLMA will be presented and discussed with the social welfare and youth departments of the City of Dortmund.

### **3. Updating the realisation plan**

The research environment was followed based on the proposed research methods while taking into account emerging research related to our study. Although the timelines differed between the cities, the same research framework was replicated across all the case study cities.

### **4. Work that has not led to a solution**

All planned working steps and outputs were achieved, and all the work has led to results.

### **5. Compliance with expenditure and time planning**

Despite delays caused by external factors, the time planning and thus expenditures are in line with the workplan of the proposal. First Consortium Workshop (8th to 9th June 2022), Second Consortium Workshop (30th Nov to 1st Dec 2022), Third Consortium Workshop (March 29th to April 1st, 2023), Fourth Consortium Workshop (26th Feb to 27th Feb 2024), Fifth Consortium Workshop (25. November bis 29. Nov). Validation Workshops: To fortify the validity and reliability of the developed cascading effects, validation workshops were conducted in each of the three case study areas:

- 4th to 15th September 2023, Dortmund, Germany,
- 21st September 2023, São Paulo, Brazil
- 28th November 2023, Cape Town, South Africa

## Appendices

### Appendix 1: Livelihood Profiles

#### CLUSTER ONE: Critically Impacted by the Pandemic

##### ILLUSTRATIVE CASE 1: 4p22whr9yia9

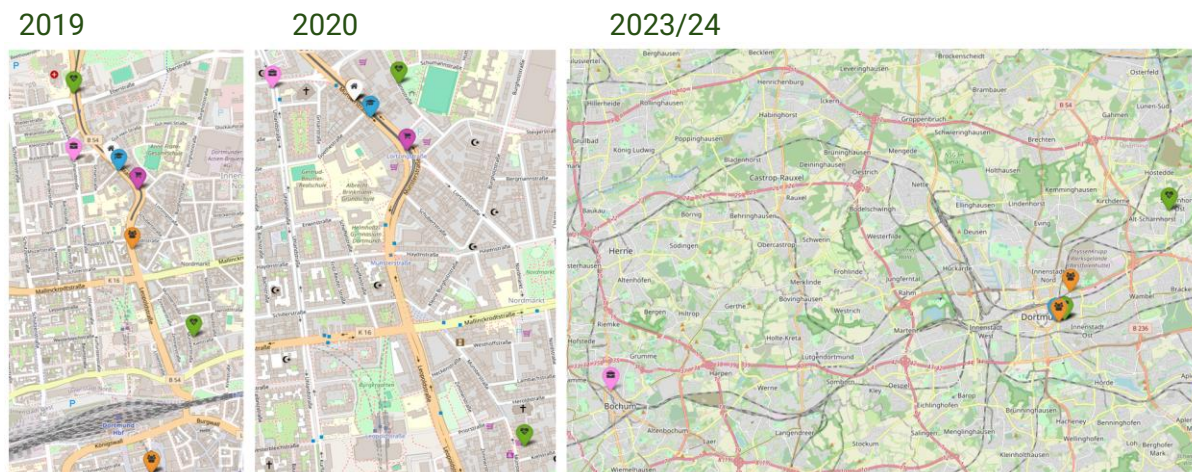


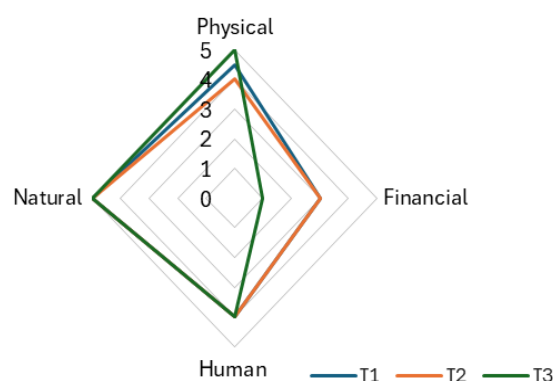
Figure 1: Spatial Representation of Movement Patterns and Activity Locations (2019–2024)

Household	Gender	Age
Respondent	Male	36-45
Resident 2	Female	26-35
Resident 3	Male	5-13
Resident 4	Female	5-13

#### LIVELIHOOD CHARACTERISTICS, VULNERABILITIES, AND OPPORTUNITIES

The household comprises four members - a couple and their school-aged children. The father, aged between 36 to 45 years old, has attained secondary level education. In 2019 and during the first lockdown of 2020, he was self-employed, navigating the uncertainties of freelance work. However, after the pandemic, in 2023, he made a transition and secured an employed position. His monthly income ranges from €1,001 and €2,000. His wife, aged between 26 and 35, holds a diploma. They both have a son and a daughter, aged between 5 and 13 years, who are enrolled in primary school.

Together, the household shares a combined income of approximately €1,500.



#### IMPACT OF THE PANDEMIC SHOCK

The father, who is the primary respondent, reported experiencing the most profound socioeconomic and psychological impacts of the COVID-19 pandemic: he lost his business, along with clients and capital essential to his self-employment. This disruption not only affected the family's immediate livelihood but also their long-term economic security and sustenance. In addition to financial hardship, he reported significant emotional distress associated with the pandemic was immense, with widespread feelings of fear about illness, heightened anxiety, and a general sense of uncertainty. The family's socioeconomic condition

was compounded by the loss of reliable heating in the winter months and an eventual job loss. The household also faces challenges in digital connectivity through unstable internet connections and a lack of digital support facilities during a period in which access to online services was essential.

### COPING STRATEGIES (VIRTUAL AND PHYSICAL MOBILITIES)

- A shift from self-employment during the pandemic to wage employment in Bochum, demonstrating a desire to regain financial stability, despite lower earnings.
- Increased travel since the pandemic to make ends meet.
- Minimal virtual engagement, primarily due to an unstable internet connection at home and difficulty navigating online systems.
- Engaged in online education activities.

### RECOVERY NEEDS

- Stable and affordable internet access to enable participation in education, employment, & social life.
- Digital literacy and support services to help the household confidently engage in online environments.
- Financial support and business grants for the father to rebuild his entrepreneurial capacity.
- Psychosocial counselling and mental health support to address ongoing anxiety, trauma from business loss, and fear of illness.
- Housing support or infrastructure improvement.

### CLUSTER ONE: Critically Impacted by the Pandemic

#### ILLUSTRATIVE CASE 2: 8my99ukg6ztd

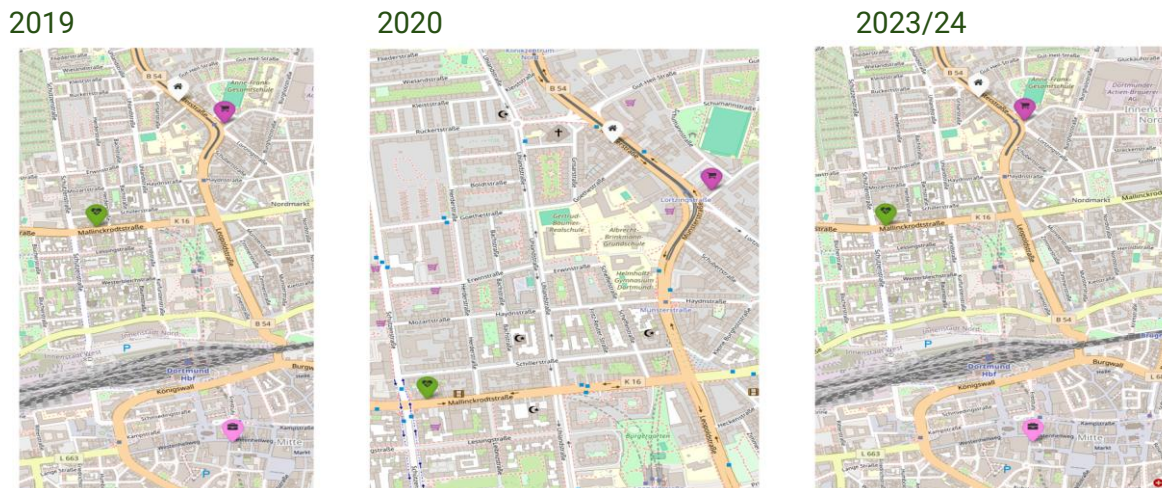
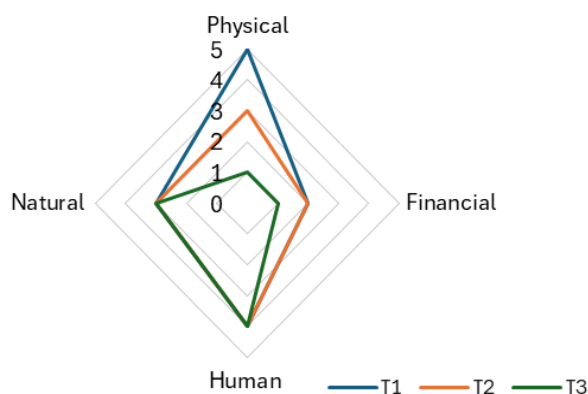


Figure 2: Spatial Representation of Movement Patterns and Activity Locations (2019–2024)

Household	Gender	Age
Respondent	Female	36-45
Resident 2	Male	46-55
Resident 3	Male	5-13
Resident 4	Female	5-13
Resident 5	Unknown	Unknown
Resident 6	Unknown	Unknown

## LIVELIHOOD CHARACTERISTICS, VULNERABILITIES, AND OPPORTUNITIES

The household is a large family consisting of more than six members. The respondent is a woman between the ages of 36 and 45 who holds a college entrance qualification. She is currently employed and simultaneously pursues studies or apprenticeship training. Originally from Syria, she relocated to Germany in 2015, accompanied by her children. Her partner, a Syrian man aged between 46 and 55, has attained diploma-level education. The couple has at least two children, two of whom are between the ages of 5 and 13.



One daughter is on the academic track toward Abitur (university entrance qualification), while the son is enrolled in primary school. The household's income was not specified, however, statements about financial stress suggest limited financial resources. Despite reporting a lack of chronic illness by the respondent, the household is medically vulnerable, with the husband having undergone three heart surgeries and a child experiencing breathing issues.

## IMPACT OF THE PANDEMIC SHOCK

The COVID-19 pandemic struck this household with considerable intensity, exposing its economic fragility, emotional vulnerability, and social uncertainty. The mandatory use of masks posed direct health challenges, particularly for a child with asthma and for the respondent herself, who experienced breathing difficulties. These conditions triggered heightened anxiety within the household, especially given the husband's status as a high-risk patient due to prior heart surgeries. The emotional toll was compounded by the children being repeatedly sent home from school at the slightest sign of illness, interrupting their educational routines and placing additional burden on the parents. For this family, the pandemic extended beyond a public health emergency, manifesting as a prolonged period of psychological stress, confusion, and instability.

## COPING STRATEGIES (VIRTUAL AND PHYSICAL MOBILITIES)

- Maintained employment and training, showing resilience and a strong will to secure long-term economic stability.
- Household-level emotional support by both parents for the children during school closures.
- Limited physical mobility during lockdowns, either due to fear of exposure or health concerns related to their high-risk status.

## RECOVERY NEEDS

- Targeted financial support to ease the burden of high rent and food costs.
- Digital literacy and access programs to enhance the family's ability.
- Mental health and trauma-informed care, particularly focused on pandemic-induced anxiety, fear, and stress.
- Health support for vulnerable family members, especially at-risk patients.

## CLUSTER TWO: Better than Pre-pandemic Times

### ILLUSTRATIVE CASE 3: 4yz6ytg3lld7

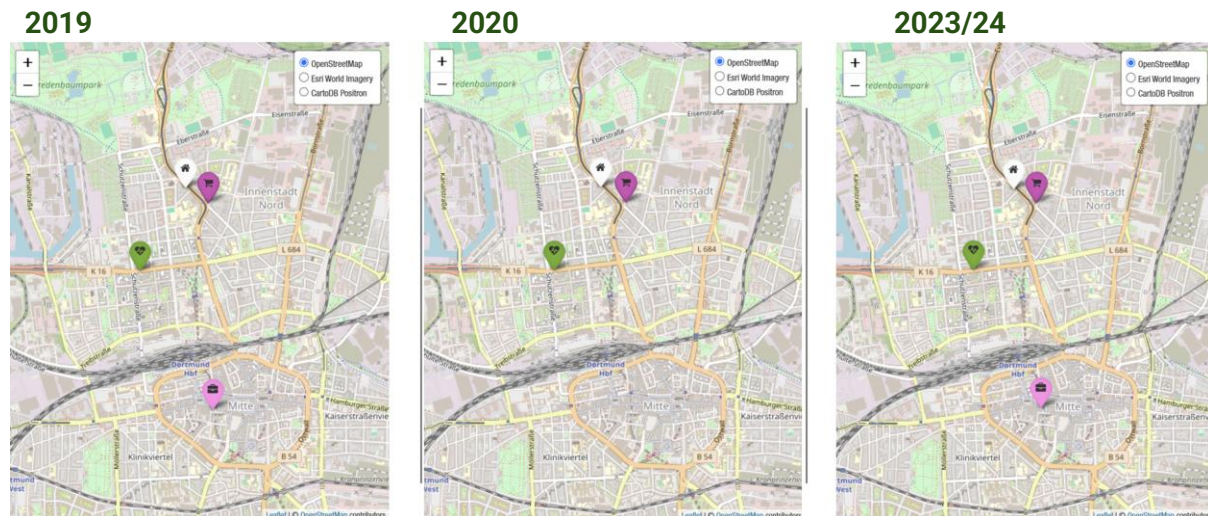
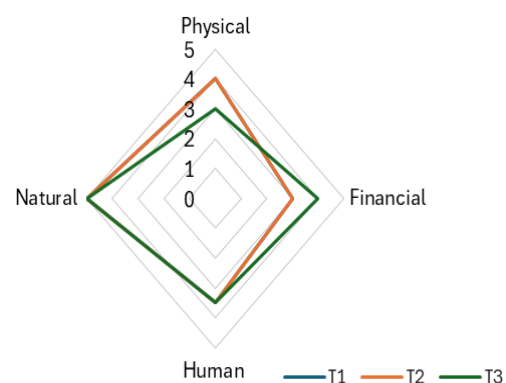


Figure 2: Spatial Representation of Movement Patterns and Activity Locations (2019–2024)

Household Respondent	Gender Female	Age 36-45
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## LIVELIHOOD CHARACTERISTICS, VULNERABILITIES, AND OPPORTUNITIES

The household is a shared living arrangement (WG) comprising four individuals, one of whom is a woman between the ages of 26 and 35 and the main respondent for the research. Originally from Turkey, she relocated to Germany in 2019, bringing with her a Bachelor's degree and aspirations for personal and professional development. Upon arrival, she balanced employment with either studies or an apprenticeship program. As is common in urban areas, especially for newcomers, the shared apartment offered a practical and affordable housing solution. The residence provided adequate space and conditions to support both living and working from home.



## IMPACT OF THE PANDEMIC SHOCK

The onset of the COVID-19 pandemic brought about a significant disruption in her life trajectory. In 2020, she faced unemployment, a stark contrast to her active employment and educational engagement the year before. The scarcity of jobs and reduced working hours resulted in an unstable income and a precarious financial situation. While her current monthly earnings fall within the €2,001–€3,000 range, this stability is relatively recent and follows a period marked by economic strain. She was vulnerable to labour market volatility, particularly in sectors heavily affected by lockdowns and remote work transitions. Nonetheless, she gained employment in 2023 post-pandemic, thus an improvement from the circumstances of the pandemic.

## COPING STRATEGIES (VIRTUAL AND PHYSICAL MOBILITIES)

- Transitioned work and study-related activities online with relative ease.
- Maintained social ties and support networks virtually.

### RECOVERY NEEDS

- Stable employment opportunities.
- Career development support to transition fully into the post-pandemic labour market.
- Access to affordable shared housing or support for independent living as income stabilises.

### CLUSTER TWO: Better than Pre-pandemic times ILLUSTRATIVE CASE 4: 2sy7p33ezc78

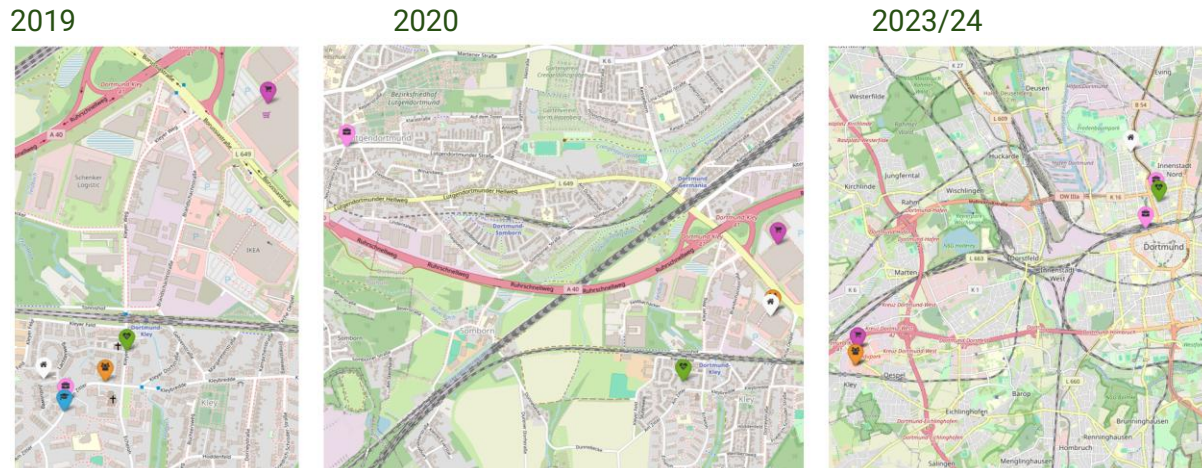
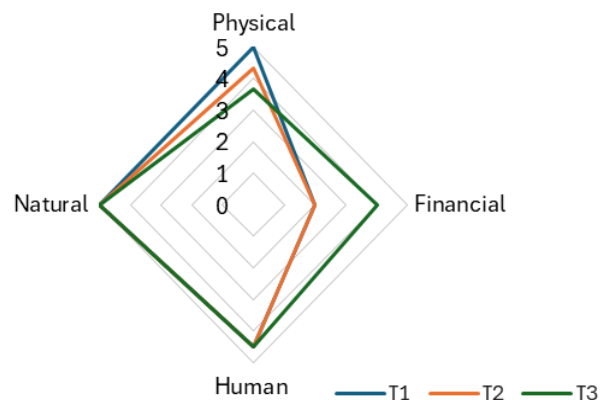


Figure 4: Spatial Representation of Movement Patterns and Activity Locations (2019–2024)

Household	Gender	Age
Respondent	Female	36-45
Resident 2	Male	36-45
Resident 3	Female	0-5

### LIVELIHOOD CHARACTERISTICS, VULNERABILITIES, AND OPPORTUNITIES

The household consists of a couple with one young child. The woman who was the respondent, aged between 36 and 45, holds a Bachelor's degree and migrated from Morocco in 2018. Her trajectory in Germany began as a student/apprentice in 2019, a path interrupted by a period of unemployment during 2020 due to the pandemic, before resuming her training. Her partner, also aged between 36 and 45, likewise holds a Bachelor's degree and has resided in Germany since 1997, suggesting a relatively long duration of stay and probable familiarity with the socio-cultural context.



The couple has a daughter born in 2020. The total household income amounts to approximately €2,500 per month, indicating modest financial resources.

### IMPACT OF THE PANDEMIC SHOCK

The COVID-19 pandemic had a destabilising impact on this household, both economically and socially. With no employment during the height of the pandemic, the household faced significant financial challenges. This economic vulnerability was compounded by spatial and emotional stressors, including limited living space and heightened fear of illness. The psychological burden manifested in increased stress within family life, exacerbated by the demands of remote learning and caregiving for a newborn. Communication barriers, likely related to limited German language proficiency, further complicated access to services and information. A positive aspect for the respondent was the uninterrupted continuation of her education through online learning, thereby ensuring academic progress despite the pandemic. As a result of the pandemic, this family faced the challenge of economic insecurity, health anxieties, and social isolation.

### COPING STRATEGIES (VIRTUAL AND PHYSICAL MOBILITIES)

- Virtual use of online learning platforms to maintain educational progress
- Limited physical mobility due to lockdowns and caregiving duties.
- Continued engagement in formal education.

### RECOVERY NEEDS

- Intensive German language acquisition programs, tailored to adults with caregiving responsibilities.
- Targeted employment support and income-generating work aligned with existing skills.
- Affordable and adequate housing solutions to reduce the stress that comes with a tight living space.
- Psychosocial counselling and mental health support to address post-pandemic emotional strain.
- Community integration programs to foster belonging and reduce social isolation.

### CLUSTER THREE: Status Quo Maintained

#### ILLUSTRATIVE CASE 5: 7gh4o4pr7tu6

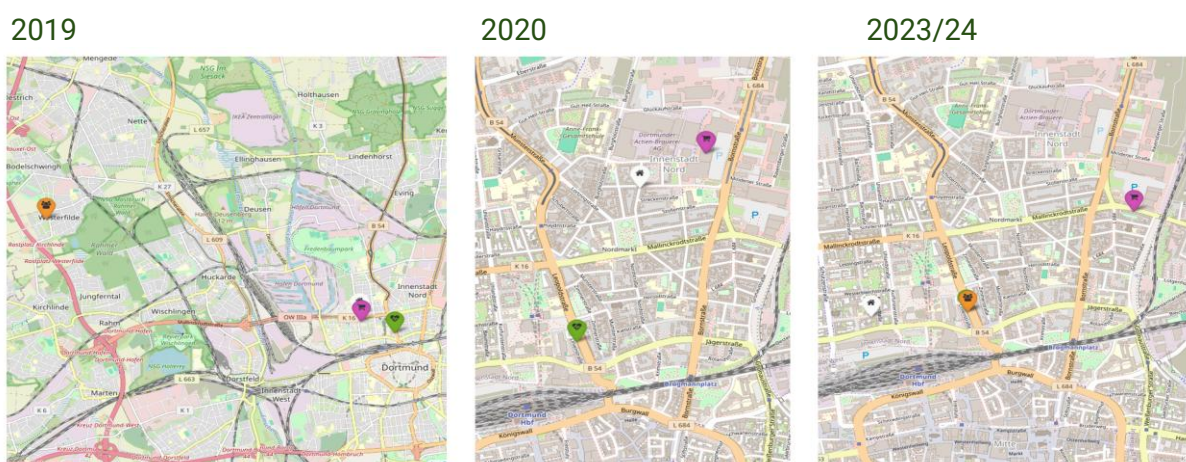
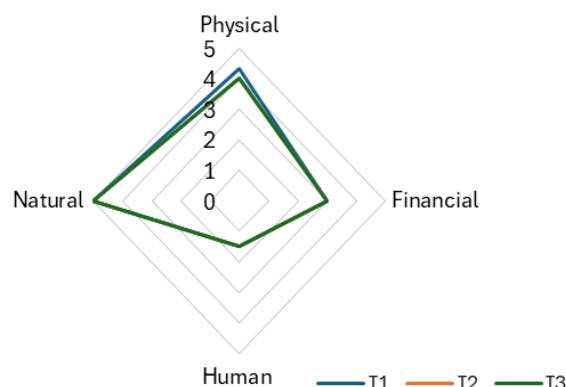


Figure 5: Spatial Representation of Movement Patterns and Activity Locations (2019–2024)

Household	Gender	Age
Respondent	Male	18-25
Resident 2	Unknown	Unknown
Resident 2	Unknown	Unknown

### LIVELIHOOD CHARACTERISTICS, VULNERABILITIES, AND OPPORTUNITIES

The household comprises three individuals, including a young man aged between 18 and 25 years, who resides with a partner. The household reports a total monthly income of approximately €1,000. The young man holds a Hauptschulabschluss and identifies as a migrant. His employment history has been characterised by prolonged instability, with recorded unemployment in 2019, 2020, and 2023, and income consistently below the €520 mini-job threshold. These intersecting factors position the individual and household within a structurally vulnerable demographic, particularly susceptible to socio-economic shocks.



### IMPACT OF THE PANDEMIC SHOCK

The COVID-19 pandemic exerted a pronounced strain on the household, particularly impacting the young man's psychosocial well-being and patterns of mobility. The imposition of mask mandates, especially the fluctuating requirements around FFP2 masks, had a significant deterrent effect on his use of public transport. This not only (self-)restricted access to essential services and social networks but also compounded feelings of isolation. Similarly, the act of grocery shopping became distressing, exacerbated by spatial distance and hostile interpersonal encounters in retail settings. Social and recreational life suffered as well; hobbies such as attending football stadiums were suspended, further contributing to a sense of disconnection and loss of routine.

### COPING STRATEGIES (VIRTUAL AND PHYSICAL MOBILITIES)

- Minimisation of physical trips due to discomfort with mask-wearing and changes in transport access.
- Avoidance of public transport, particularly trains, as a result of mask policy changes.

### RECOVERY NEEDS

- Improved access to digital infrastructure and training to reduce barriers in online mobility.
- Skill-building programs and integration into stable labour markets, especially for young migrants.
- Household income support or housing assistance, to ease financial stress and prevent further socio-economic exclusion.

### CLUSTER THREE: Status Quo Maintained

#### ILLUSTRATIVE CASE 6: 4d9ln6o7p4y6

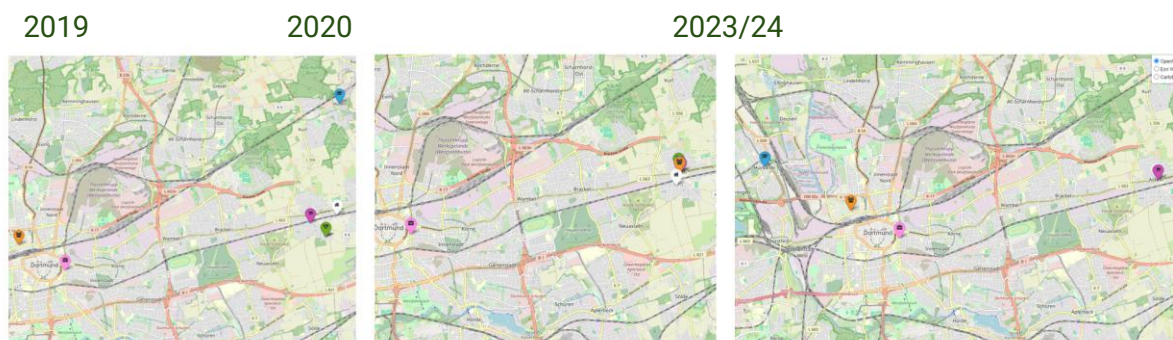


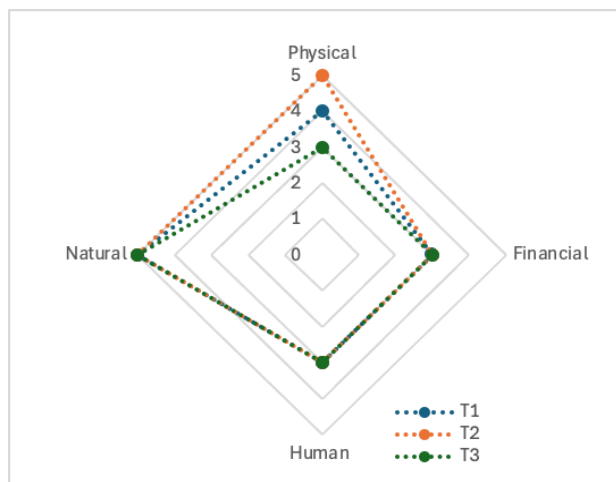
Figure 6: Spatial Representation of Movement Patterns and Activity Locations (2019–2024)

Household	Gender	Age
Respondent	Female	56-65
Resident 2	Male	18-25

### LIVELIHOOD CHARACTERISTICS, VULNERABILITIES, AND OPPORTUNITIES

The household is headed by a woman in her late-50s to mid-60s, and lives with her adult son aged 18-25. She was born and raised by Polish parents in Germany. She holds a Mittlerer Bildungsabschluss/ Realschulabschluss, while her son has completed his Hauptschulabschluss.

The household’s financial situation stood on solid ground since the respondent had consistent access to formal work in 2019, 2020, and 2023. She travels around 30 to 45 minutes by subway, tram, or train to and from work. Likewise, the households’ monthly income, which was between 1,000 to 2,000 euros, remained steady across the different phases of the pandemic. When asked about the effect of the crisis on her livelihood, she responded: *“There was no difficulty for my work. I could get income”*. Their pandemic experience is defined by stability—a stark contrast to many others who were thrown into economic uncertainty.



### IMPACT OF THE PANDEMIC SHOCK

While their financial situation during the pandemic remained unshaken, there were also signs of vulnerability from the pressures of sustaining the household alone. The respondent faced emotional and social challenges, resulting from the inability to meet her friends and family. The isolation weighed heavily on her well-being, as she described the experience “horrible” and one of the hardest aspects of the lockdown.

She was able to overcome these challenges with the help of her son, who was more familiar with technology, which introduced her to online grocery shopping. Through her son’s constant guidance, she was eventually able to shift to the use of different digital platforms for purchasing their daily needs. But beyond that, she also began attending hybrid church services—an adaptation which helped her remain connected to her faith community from the safety of home. She views her gradual adaptation to new technologies as a personal benefit, stating how it has helped manage their needs, given her a sense of continuity and comfort during a time of uncertainty, and allowed their household to navigate the disruption without bearing significant losses.

### VIRTUAL AND PHYSICAL MOBILITIES, AND OTHER COPING STRATEGIES

- Relied on her son’s digital literacy to learn how to use online services
- Adopted online shopping platforms (eg, PicNic)
- Began attending hybrid church services online

### RECOVERY NEEDS

- Sustained implementation of hybrid religious and community platforms, as a means to provide convenient or alternative options for older adults’ social and cultural participation;
- Digital literacy programs for older adults
- Neighbourhood-level social support programs

**CLUSTER FOUR: Improved through Change and Sustained Over Time**  
**ILLUSTRATIVE CASE 7: 96rid79llu4m**

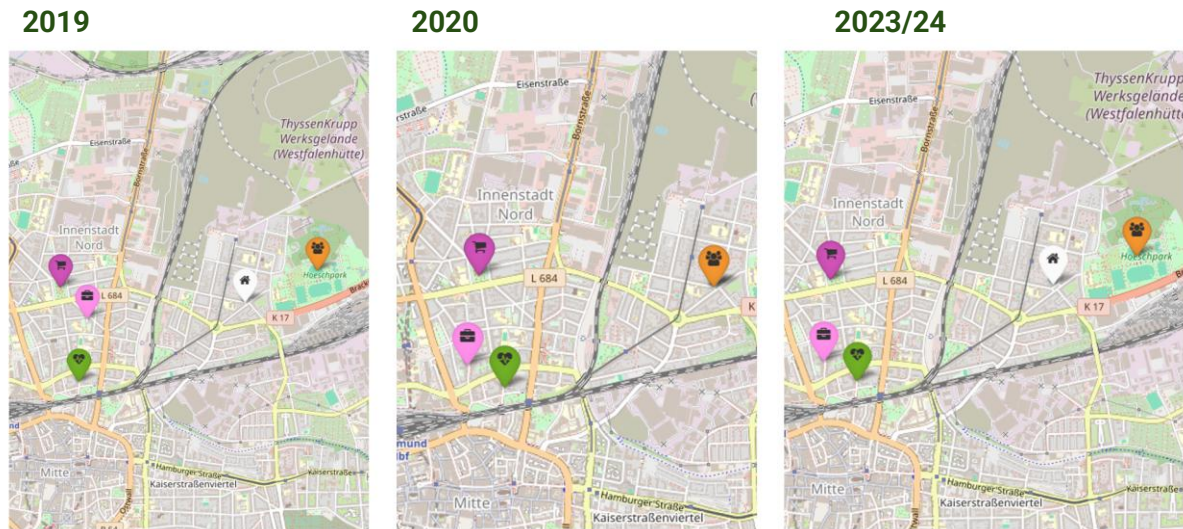


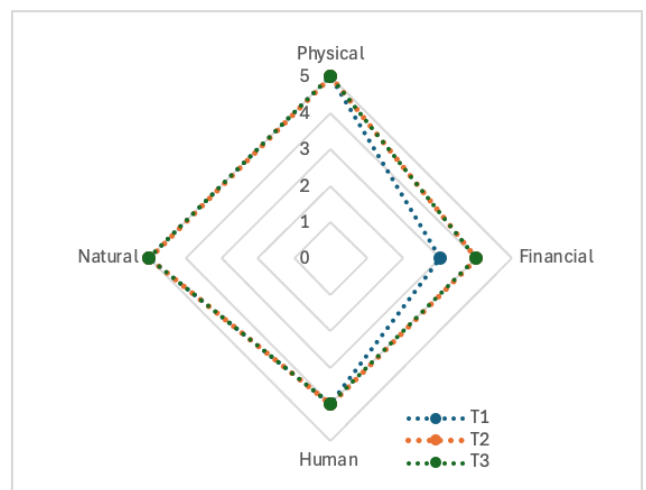
Figure 7: Spatial Representation of Movement Patterns and Activity Locations (2019–2024)

Resident	Gender	Age
Respondent	Female	36-45
Resident 2	Unknown	Unknown
Resident 3	Unknown	Unknown
Resident 4	Unknown	Unknown
Resident 5	Unknown	Unknown
Resident 6	Unknown	Unknown

**LIVELIHOOD CHARACTERISTICS, VULNERABILITIES, AND OPPORTUNITIES**

This six-person household is represented by a woman in her mid-30s to mid-40s, who lives with her husband, three children, and another family member. The respondent was born in Morocco and had spent a part of her life in Spain. She holds a Mittlerer Bildungsabschluss/ Realschulabschluss. She has been building a life for her family in Germany since 2017, with steady formal employment in 2019, 2020, and 2023, while her husband works as an electrician.

Although she did not disclose her monthly income, the family’s financial situation showed signs of improvement during the pandemic, especially when her husband received a pay raise. This increase in earnings has been of significant help for the household to transition from a more precarious pre-pandemic state



into a period of relative financial stability, one that they managed to maintain even in the post-pandemic years.

### IMPACT OF THE PANDEMIC SHOCK

While the household's finances improved significantly during the pandemic, the emotional toll was harder to navigate. The constant stream of negative news during the pandemic often instilled feelings of fear and anxiety in the respondent. The pressure to adapt to the new reality, marked by uncertainty and isolation, made life feel more fragile each day.

However, the presence of technology played an important role in her ability to cope and navigate through these emotional challenges. With a stable Wi-Fi connection at home, she became more accustomed to online services such as WhatsApp, which was the main platform she used in maintaining connection with loved ones. She recalled how the regular exchanges of photos and messages between her and family members and friends somehow gave her a sense of continuity during the periods of isolation.

Truly, the pandemic has brought stress and emotional fatigue, but the household emerged with a stronger disposition. Their financial stability improved, their digital skills enhanced, and their social ties were maintained. The family's narrative portrays an upward shift even during a time of global disruption, and sustained it through the years that followed.

### VIRTUAL AND PHYSICAL MOBILITIES, AND OTHER COPING STRATEGIES

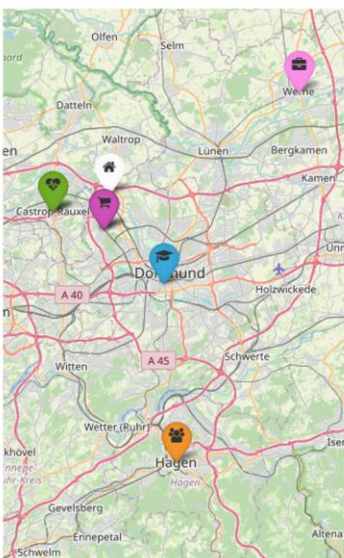
- Adapted to the use of online services with the help of home internet
- Maintained social connections through WhatsApp and digital communication

### RECOVERY NEEDS

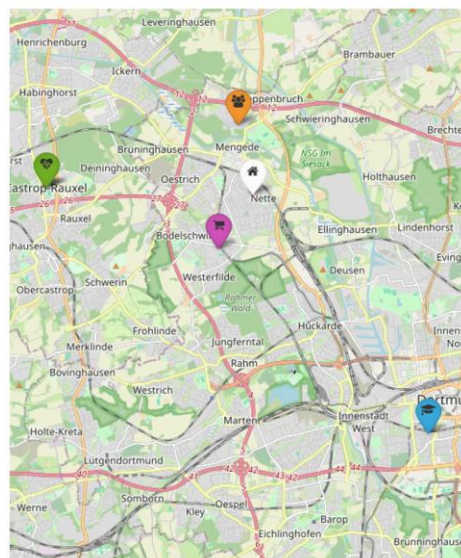
- Psychosocial, or mental health services for pandemic-induced anxiety
- Income support programs are facing irregular employment income due to sectoral volatility
- Regularisation program to improve employment security

### CLUSTER FOUR: Improved through Change and Sustained Over Time ILLUSTRATIVE CASE 8: 7ff9beg7zr38

2019



2020



2023/24

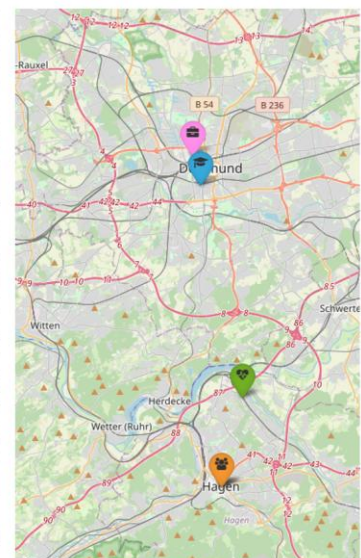


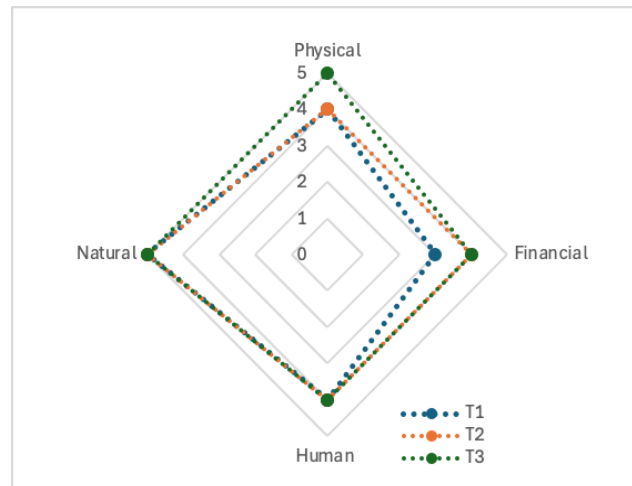
Figure 8: Spatial Representation of Movement Patterns and Activity Locations (2019–2024)

Household	Gender	Age
Respondent	Female	36-45
Resident 2	Male	18-25

### LIVELIHOOD CHARACTERISTICS, VULNERABILITIES, AND OPPORTUNITIES

The household consists of two members: a woman in her mid-30s to mid-40s, and her adult son, aged 18-25. The respondent migrated from Italy to Germany in 1986 and has since built a long-standing life in the country. She holds a Bachelor’s degree, while her son completed his *Hauptschulabschluss*. The respondent is in a relationship, but her partner does not live with her, and her son just moved in during the pandemic.

The respondent maintained formal employment through 2019, 2020, and 2023, with a personal income between 2,000 to 3,000 euros. The total household income was approximately 3,500 euros, which the respondent considers a significant improvement in their financial situation, marked when her son moved in with her during the pandemic. This arrangement allowed them to manage their resources more efficiently.



### IMPACT OF THE PANDEMIC SHOCK

Like many, the respondent initially found the shift to online platforms relatively challenging. Even her son, who was knowledgeable of these digital services, struggled with the sudden changes in the mode of learning, finding e-learning particularly difficult at the beginning. Aside from this, the weight of the pandemic was mostly felt emotionally. The respondent described how social distancing, the loss of in-person contact, and separation from extended family created a sense of estrangement, which was particularly hard to deal with, especially during a crisis where familial support and closeness mattered most. Regardless of these disruptions, the household leaned on each other and found a way forward by adapting to the demands of the moment and navigating uncertainty together as mother and son.

### VIRTUAL AND PHYSICAL MOBILITIES, AND OTHER COPING STRATEGIES

- Continued schooling despite difficulty shifting online
- Mother and son moved in together, which potentially improved financial stability.

### RECOVERY NEEDS

- Institutional and tailored online support for school digitalisation
- Psychosocial, or mental health services

## CLUSTER FIVE: From Stability to Setback

### ILLUSTRATIVE CASE 9: 7b7j3ytb44o3

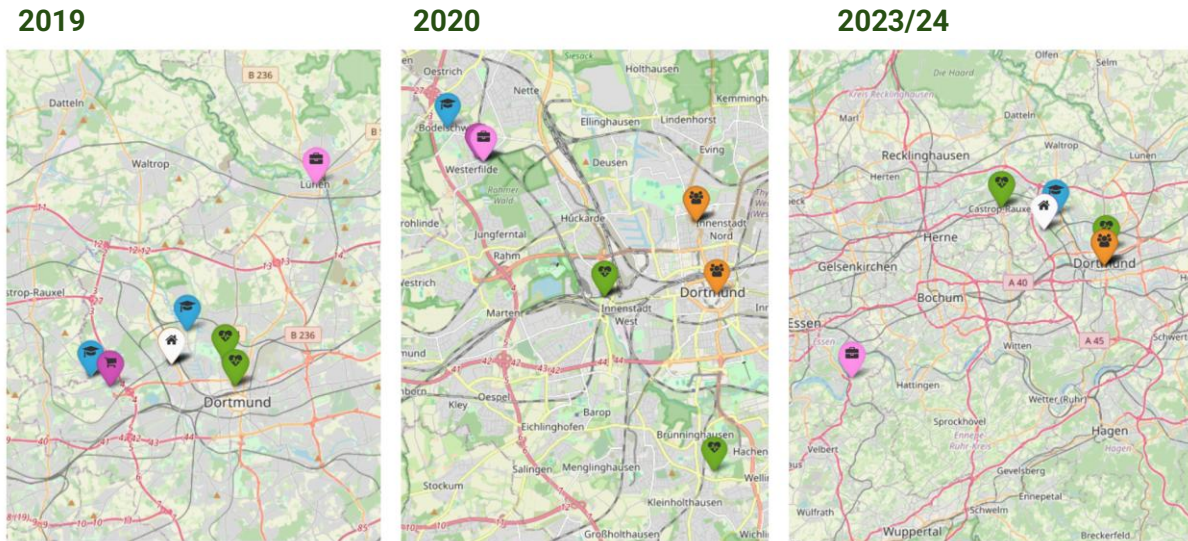


Figure 9: Spatial Representation of Movement Patterns and Activity Locations (2019–2024)

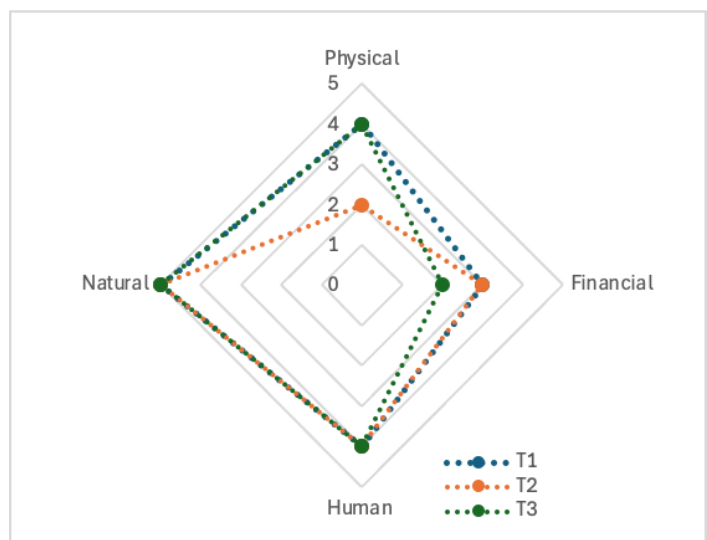
Household	Gender	Age
Respondent	Female	36-45
Resident 2	Male	46-55
Resident 3	Female	0-5
Resident 4	Male	5-13

## LIVELIHOOD CHARACTERISTICS, VULNERABILITIES, AND OPPORTUNITIES

The household consists of four members: a woman in her late 30s to mid-40s, her partner, and their two children. She and her partner are both from Syria and are raising their family in Germany. They migrated in 2018, bringing their son, aged 5-13, who now attends primary school. Their daughter, under the age of 5 years, rounded out the family between 2019 and 2020, marking a hopeful chapter of new beginnings in a new country.

Both adults have attained college entrance qualifications. She pursued additional education and was a student or apprentice in 2019, but had to stop her education during the pandemic. She was also employed in 2019 and was earning between 1,001 to 2,000 euros, but became unemployed at the start of the pandemic in 2020 until the present. Her partner's employment status is not detailed, but the total monthly household income, which was around 1,300 euros, reflects increasing financial strain over time. What began as a stable and promising situation before the pandemic was barely sustained during the pandemic, and slowly deteriorated over time.

Inflation, pandemic-related expenses such as masks and PCR tests, and the general increase



in the cost of living had placed a mounting pressure on the family's modest budget and had gravely contributed to the worsening household's financial condition.

### **IMPACT OF THE PANDEMIC SHOCK**

In the early parts of the pandemic, the family tried to adapt as best as they could. Their home had stable Wi-fi, which allowed school work and certain activities to move online. The children picked up computer skills along the way, which has been a silver lining for the family in an otherwise challenging period. However, the digital transition remained difficult, especially in supporting the children's education, as they struggled to learn during lockdown due to limitations of remote instruction.

The impacts of the pandemic went beyond education and finances, but also affected their family emotionally. The respondent lost several family members to COVID-19 who received poor treatment in hospitals and public offices during those trying times. The confusing health protocols and shifting guidelines did not help and only added to the pressures of adjusting to the situation. In the background, but no less significant, the family's precarious legal situation remained a constant and heavy presence in their daily reality. Living with temporary protection status in Germany, and only renewed annually, left them frustrated by the unjust process that did not allow them to leave the country. This temporary status made it more difficult for them to make long-term and permanent plans and decisions in their lives.

### **VIRTUAL AND PHYSICAL MOBILITIES, AND OTHER COPING STRATEGIES**

- Utilised home Wi-fi and supported children in learning digital skills

### **RECOVERY NEEDS**

- Legal assistance and residence reform to provide pathways to permanent residency
- Grief/ trauma counselling services affected by pandemic-related deaths
- Educational recovery programs to address learning loss among children during pandemic-related school closures
- Health system reform

## **CLUSTER FIVE: From Stability to Setback**

### **ILLUSTRATIVE CASE 10: 7ws2aed7rhf3**

2019

2020

2023/24

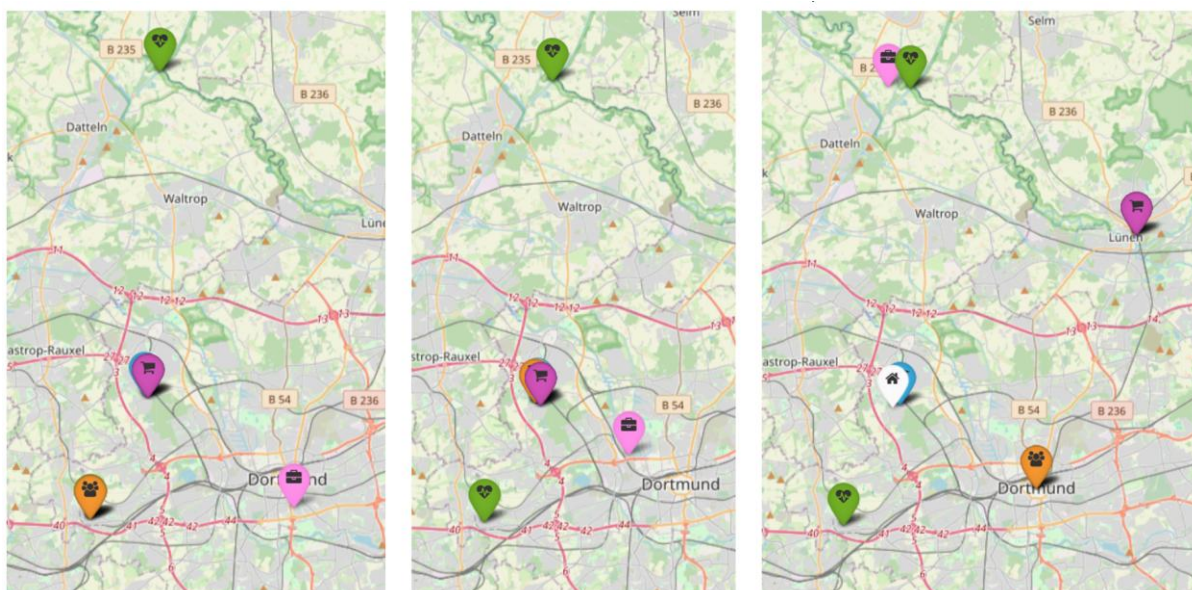


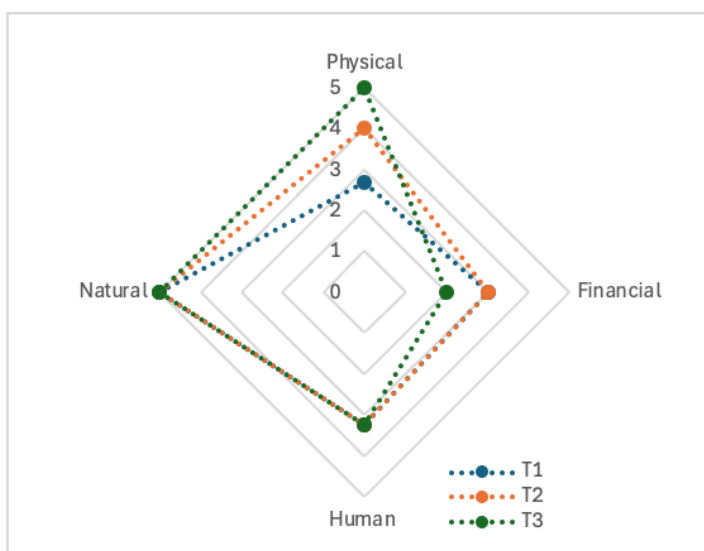
Figure 9: Spatial Representation of Movement Patterns and Activity Locations (2019–2024)

Household	Gender	Age
Respondent	Female	26-35
Resident 2	Male	26-35
Resident 3	Male	5-13
Resident 4	Female	5-13

## LIVELIHOOD CHARACTERISTICS, VULNERABILITIES, AND OPPORTUNITIES

The household consists of four members: a woman in her late 20s to mid-30s, her husband, and their two young children. The respondent and her husband were both born in Syria and migrated to Germany in 2015. Their daughter was born in Turkey in 2015, and their son was born in Germany in 2017, who are both now attending primary school. She holds a college entrance qualification, while her husband completed high school.

In 2019 and 2020, the respondent was unemployed and later in 2023, she identified her status as “other”. Her income ranged between 521 to 1,000 euros, while the total monthly household income stood at just 900 euros. Although the financial situation was relatively the same from pre-pandemic to pandemic times, by 2023, the burden had grown heavier. Her husband also lost his job during the pandemic, which meant that at that time, both adults did not have a stable source of income. Indeed, the ongoing difficulty of securing employment took a glaring toll on the family’s financial stability.



In 2019 and 2020, the respondent was unemployed and later in 2023, she identified her status as “other”. Her income ranged between 521 to 1,000 euros, while the total monthly household income stood at just 900 euros. Although the financial situation was relatively the same from pre-pandemic to pandemic times, by 2023, the burden had grown heavier. Her husband also lost his job during the pandemic, which meant that at that time, both adults did not have a stable source of income. Indeed, the ongoing difficulty of securing employment took a glaring toll on the family’s financial stability.

## IMPACT OF THE PANDEMIC SHOCK

The family experienced a mixed impact during the pandemic. On the one hand, they were able to smoothly adapt digitally through a stable Wi-Fi connection at home, which allowed for convenient use of online shopping services. However, the shift was also challenging as the family's only computer occasionally malfunctioned and made access to digital platforms unreliable. The respondent's limited internet literacy also made it difficult for her to fully utilise the benefits of these online services, especially when it came to staying socially connected.

One of the heaviest experiences came when their daughter fell ill and required surgery for a condition linked to COVID-19. Although she eventually recovered, her health never fully returned to how it was before. This left an emotional and physical weight on the family that lingers long after the crisis has seemingly passed.

### **VIRTUAL AND PHYSICAL MOBILITIES, AND OTHER COPING STRATEGIES**

- Utilised a stable Wi-fi connection at home to transition activities online

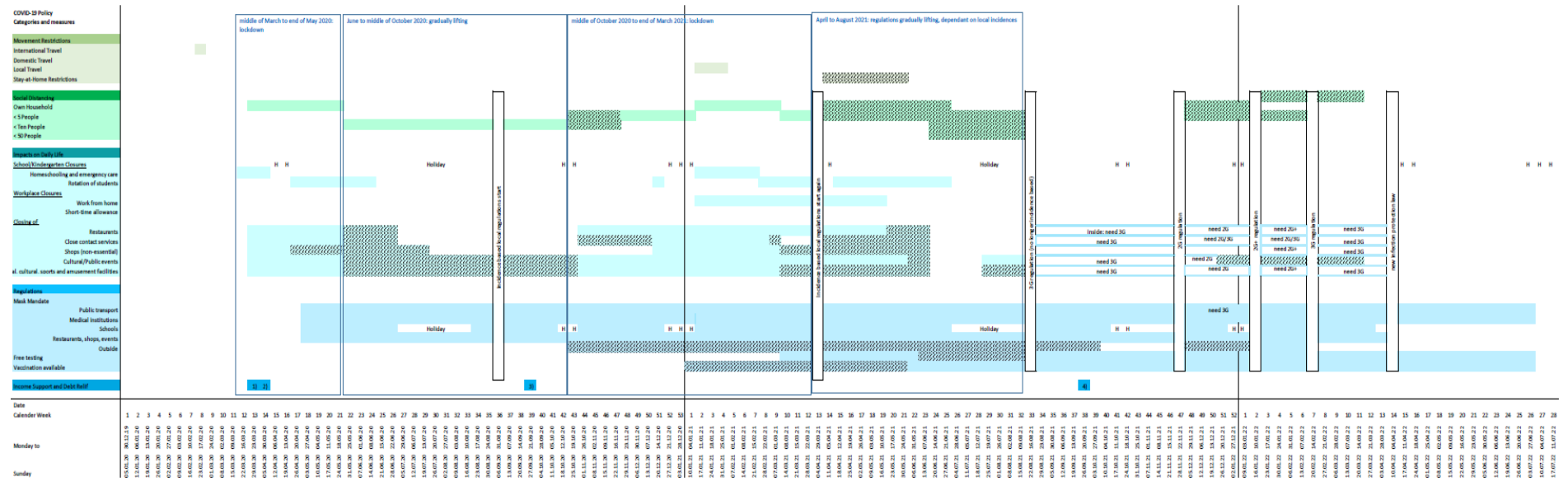
### **RECOVERY NEEDS**

- Enhanced healthcare support for COVID-19-related complications, including long-term rehabilitation services;
- Re-skilling and/or job placement services for people who lost their jobs during the pandemic
- Institutional and tailored online support for school digitalisation
- Psychosocial, or mental health services

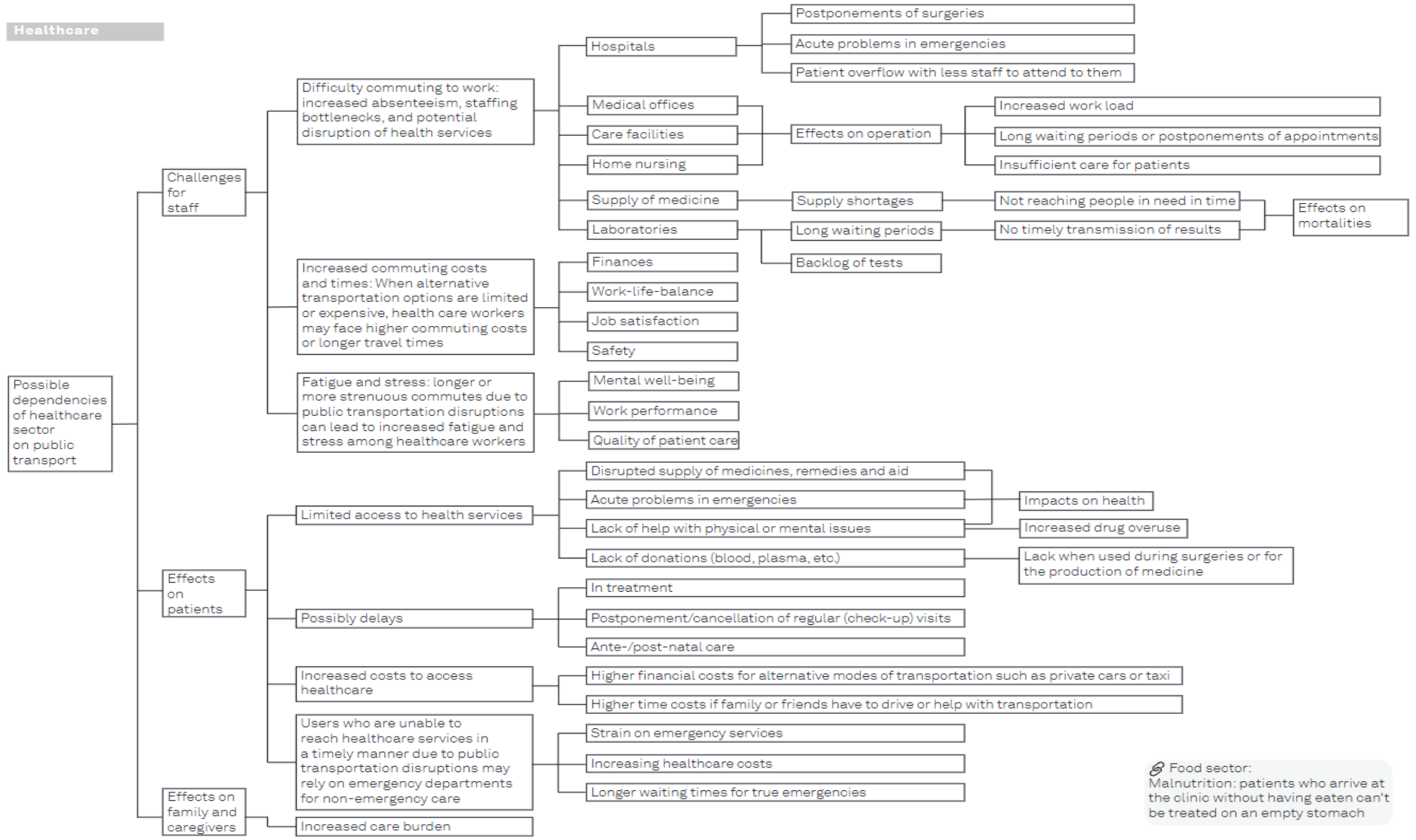
## Appendix 2: Timeline of Covid 19 measures.

The excel file can be found here: [https://tu-dortmund.sciebo.de/apps/onlyoffice/669949338?filePath=%2FICOLMA%2FWORK%20PACKAGES%2F1 Situation Analysis%2FCovid Timel](https://tu-dortmund.sciebo.de/apps/onlyoffice/669949338?filePath=%2FICOLMA%2FWORK%20PACKAGES%2F1%20Situation%20Analysis%2FCovid%20Timeline%20Ruhr.xlsx)

[ne Ruhr.xlsx](https://tu-dortmund.sciebo.de/apps/onlyoffice/669949338?filePath=%2FICOLMA%2FWORK%20PACKAGES%2F1 Situation Analysis%2FCovid Timeline Ruhr.xlsx)



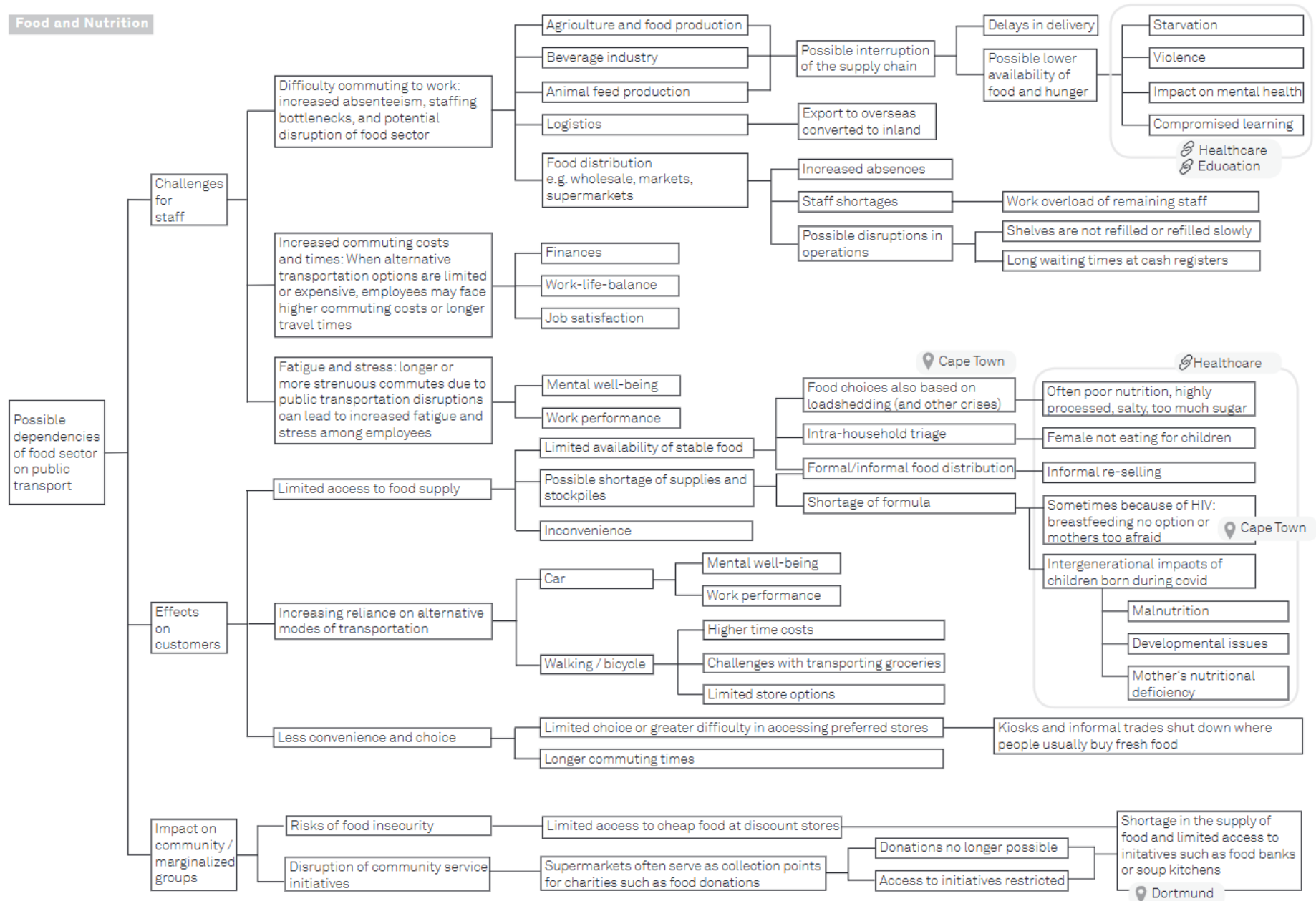
### Appendix 3: Cascading Chains (Criticality Assessment WP3)



🍴 Food sector:  
Malnutrition: patients who arrive at the clinic without having eaten can't be treated on an empty stomach

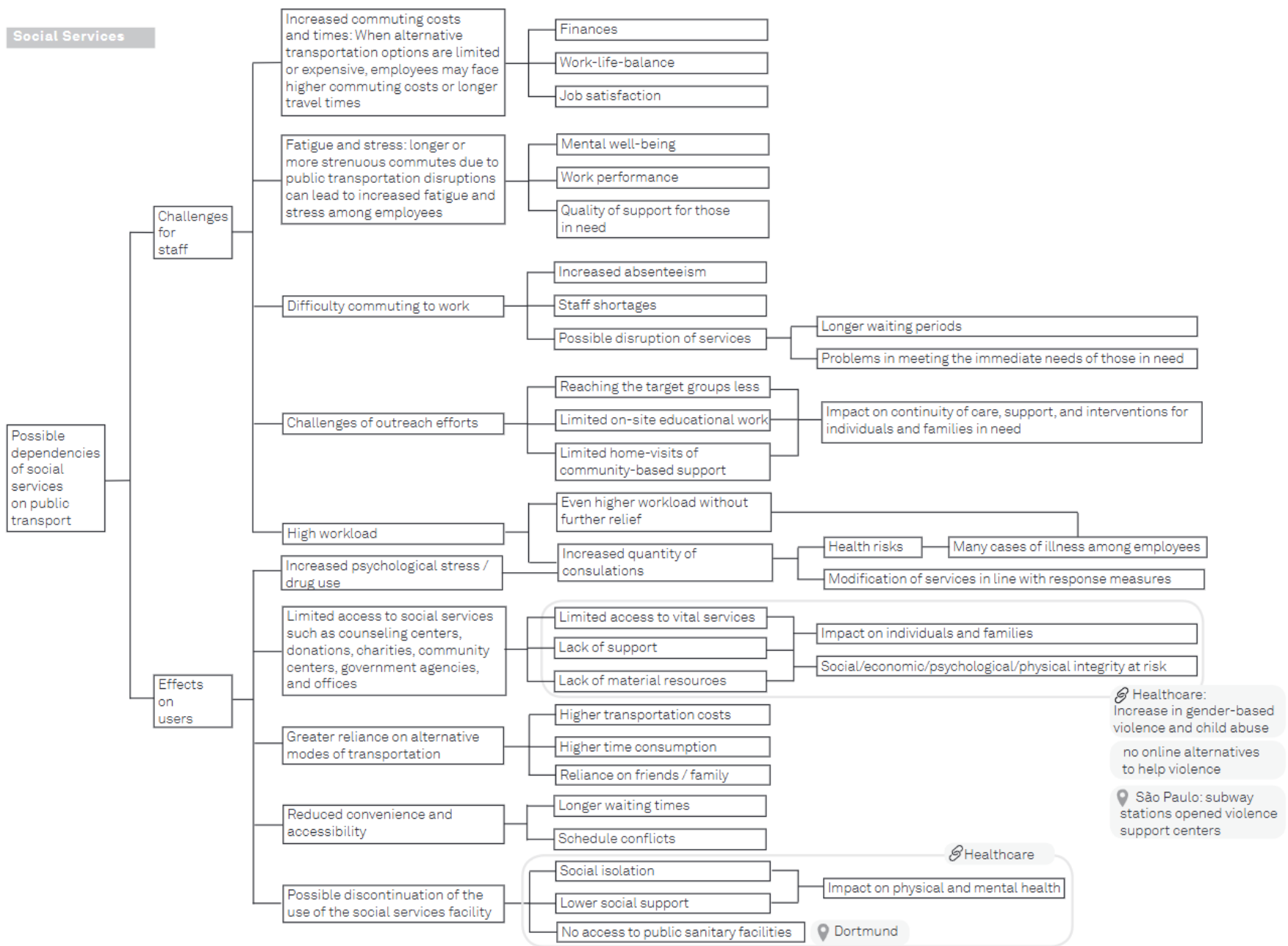
Supplementary figure 1: Cascading effects on healthcare sector

Food and Nutrition



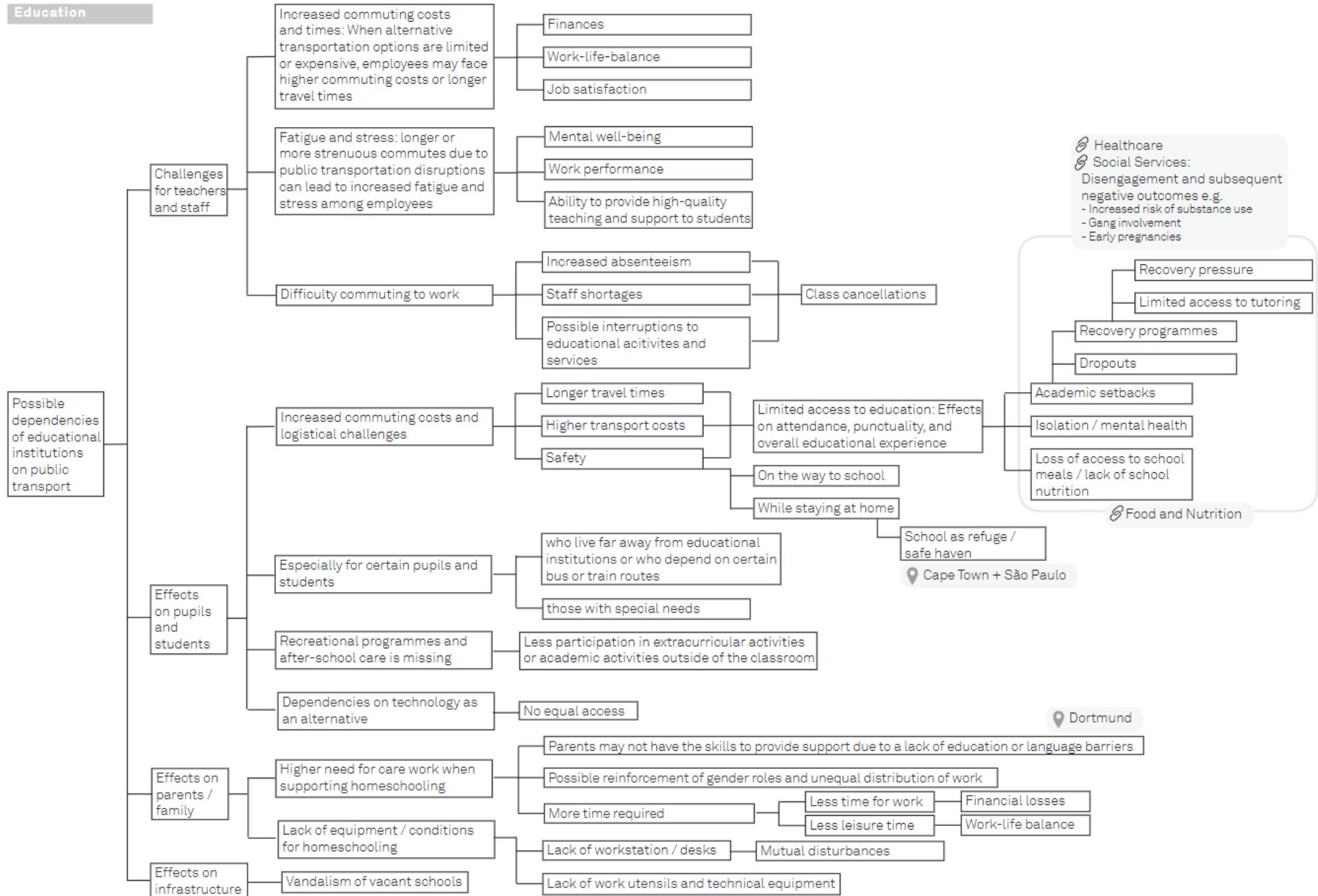
Supplementary figure 2: Cascading effects on food sector

**Social Services**



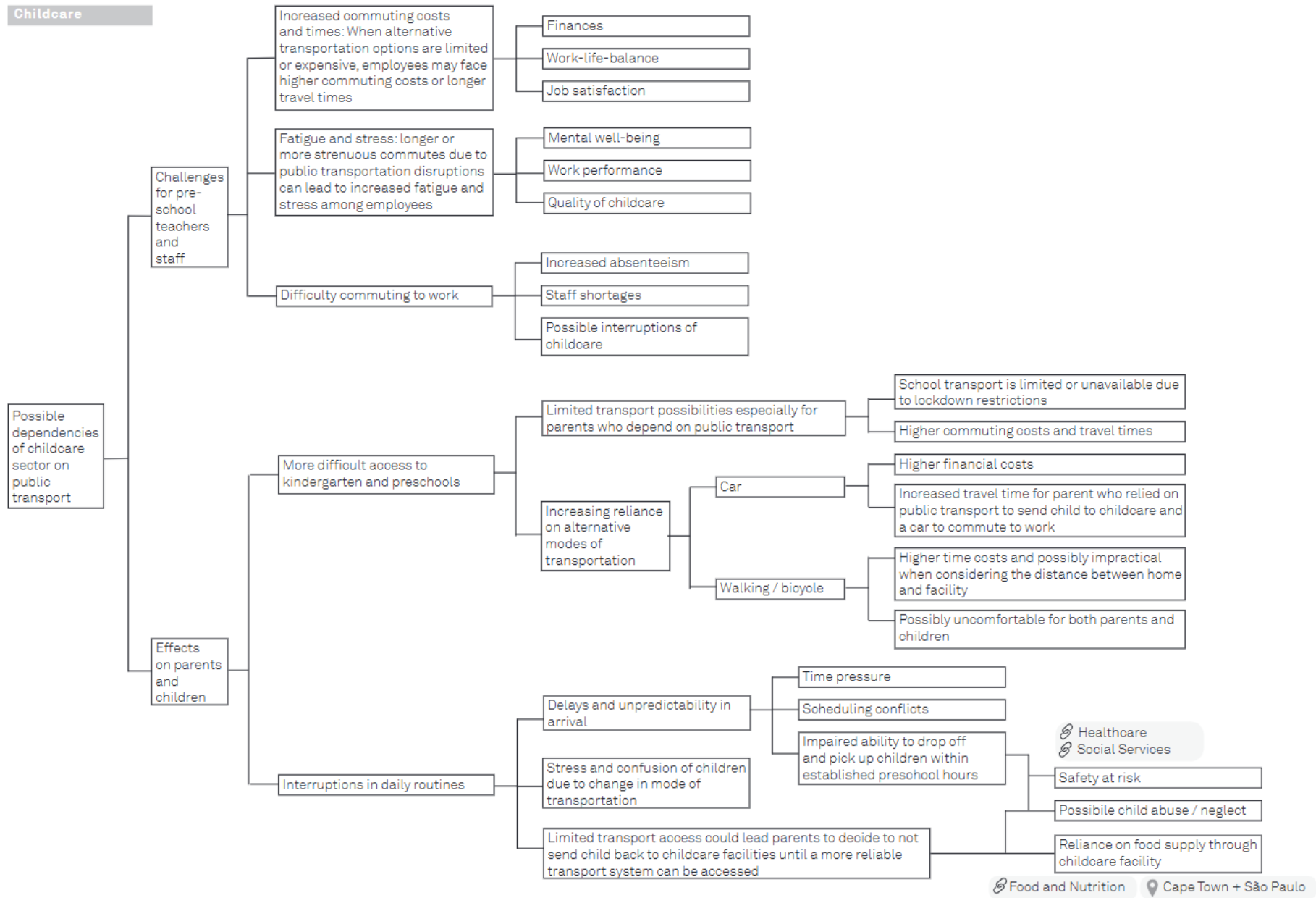
Supplementary figure 3: Cascading effects on social services sector

Education



Supplementary figure 4: Cascading effects on education sector

Childcare



Supplementary figure 5: Cascading effects on childcare sector