FAU

Interreg Alpine Space

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WP1 | Mapping Circular & Textile Actors in the Alps

MAPPING THE STATE OF ALPINE SOLUTIONS FOR CIRCULAR PRODUCTS

PART 1

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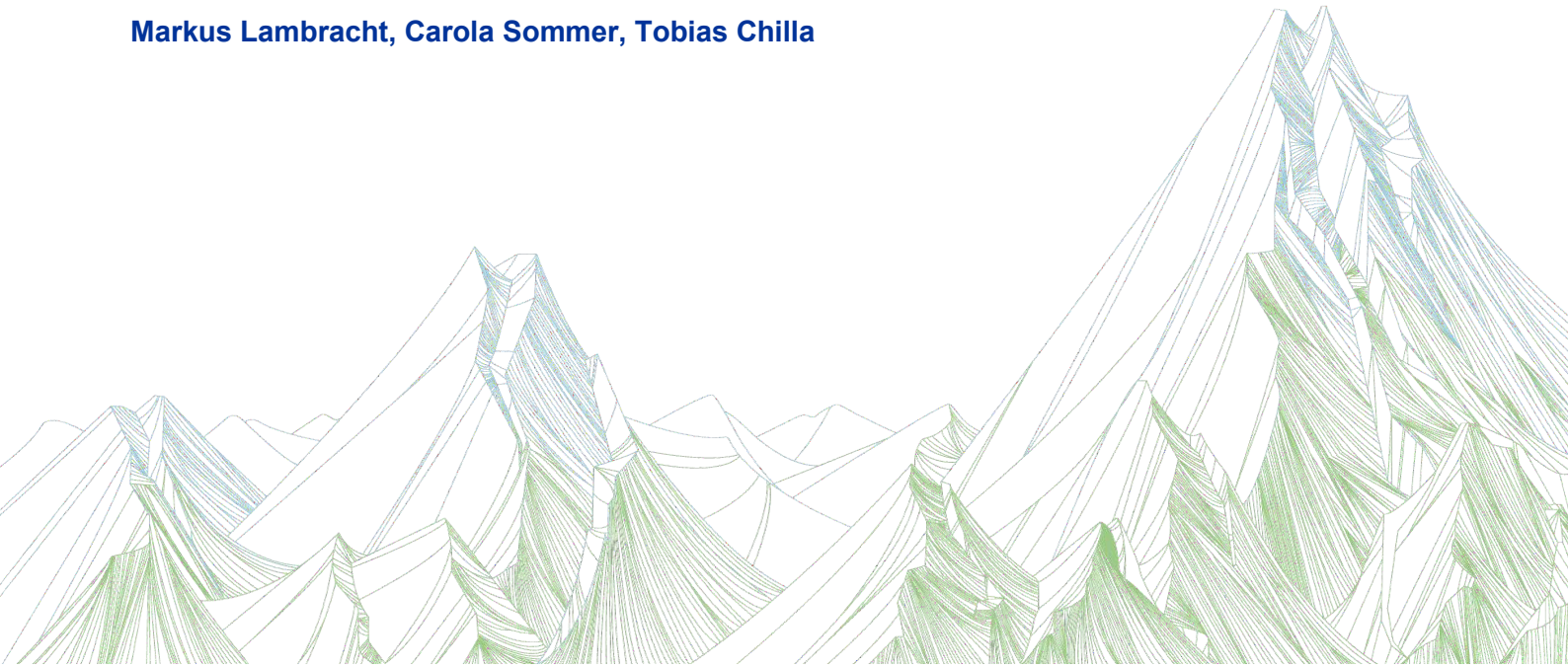

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This report is an outcome (Deliverable 1.1.1) of the Interreg Alpine Space project ASTER (https://www.alpine-space.eu/project/aster/).

It provides insights and results from work package 1 (WP1) and structures the understanding in the testing and implementation phases in WP2 and WP3 of the project.

Erlangen **2026**

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INTRODUCTION

The economy of the Alpine Region is strongly intertwined with the textile and plastic industries, which play a crucial role in supporting various sectors, including the production of essential goods for outdoor activities and tourism (Modica 2022, Šrimpf Vendramin et al. 2024, Lambracht and Chilla 2024). Key products such as sport and outdoor clothing, equipment, and infrastructure, like ski-lifts, underscore the significance of these materials within the mountain economy. However, the success of these industries in the Alpine area is accompanied by considerable environmental challenges, particularly concerning waste generation at both the production stage and the end-of-life cycle of products (Rendsburg et al. 2020; Sommer et al. 2026).

The issue of plastic and textile waste has become increasingly pressing. Global plastic waste generation has more than doubled from 2000 to 2019, culminating in a total of 353 million tonnes (OECD 2022, Lebreton and Andrady 2019). Nearly two-thirds of this plastic waste stems from products with lifetimes of less than five years, with significant contributions from packaging, consumer goods, and textiles (Hopewell at al. 2009). At the same time, textiles are put to waste with an amount of 120 million tonnes annually (Sajdeh et al. 2025). This steady increase in waste is a growing concern, given that much of the plastic in circulation is not designed to last or be reused.

Simultaneously, the textile industry has witnessed remarkable growth, with global clothing production doubling between 2000 and 2014. This increase has been fueled by the prevalence of fast fashion, characterized by rapid production cycles and low-cost, high volumes of apparel (Niinimäki et al. 2020). As a result, the amount of textile waste has escalated thoroughly, further intensifying the environmental impact of both textiles and plastics. Figure 1 by Sajdeh et al. (2025), shows, that in global textile waste streams only 7% are recyclable and 12% are reused, whereas 80% of the waste is currently left uncollected for recycling – most of this waste is either thermally recycled or sent to landfill sites. According to the European Environment Agency (EEA 2022), the global textile sector is the fourth-highest 'user' of primary materials and the fifth-highest emitter of greenhouse gases. Furthermore, 20% of water pollution arises from textile manufacturing, and the amount of waste produced after the end of the products' life is significant.

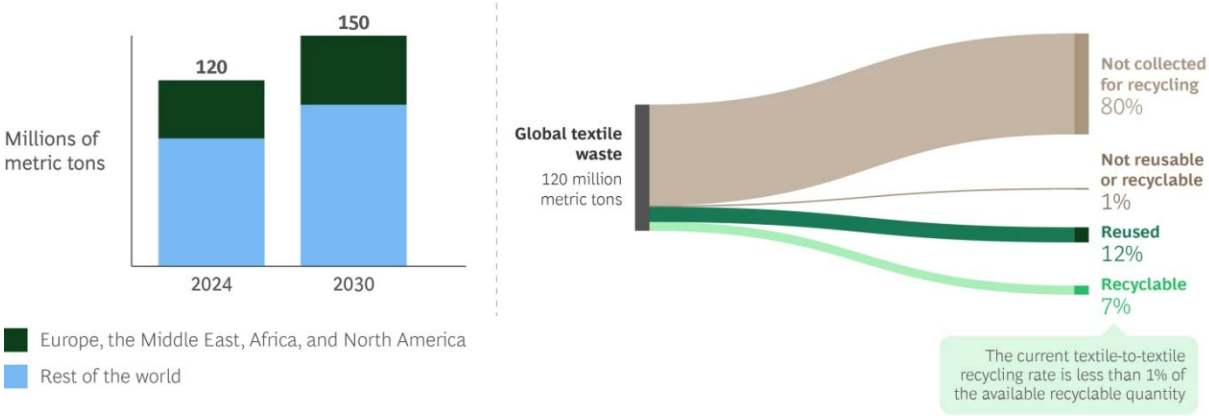

Figure 1: Textile waste from a global perspective (Source: Sajdeh et al. 2025)

Within the textile sector, synthetic fibers have gained dominance, representing around 70% of the world's fiber production. These materials, primarily derived from synthetic polymers like *polyethylene terephthalate* (PET), are favored for their affordability, ease of processing, and favorable technical properties. In contrast, natural fibers hold a lesser market share, facing challenges in scalability and cost-effectiveness (Sommer et al. 2026, Lambracht and Chilla 2024).

Given these challenges, the concept of circularity and circular economy (CE) emerges as a critical framework for sustainable development in the Alpine Region. Figure 2 presents this approach. According to European Environment Agency (EEA, 2024) the concept encourages an economic transition that seeks to establish more sustainable value chains, targeting opportunities for value creation while simultaneously addressing the pressing environmental impacts of waste generation (Korhonen et al. 2018). The concept focuses in particular longer product lifetimes, but also emphasizes practices such as refuse, reduce, reuse, repurpose, and recycle, commonly referred to as 'R-strategies' (5R/9R/10R). Its goal is to promote sustainability and circularity in the textiles and plastics sectors while supporting regional development in the Alpine region (Manninen et al. 2018).

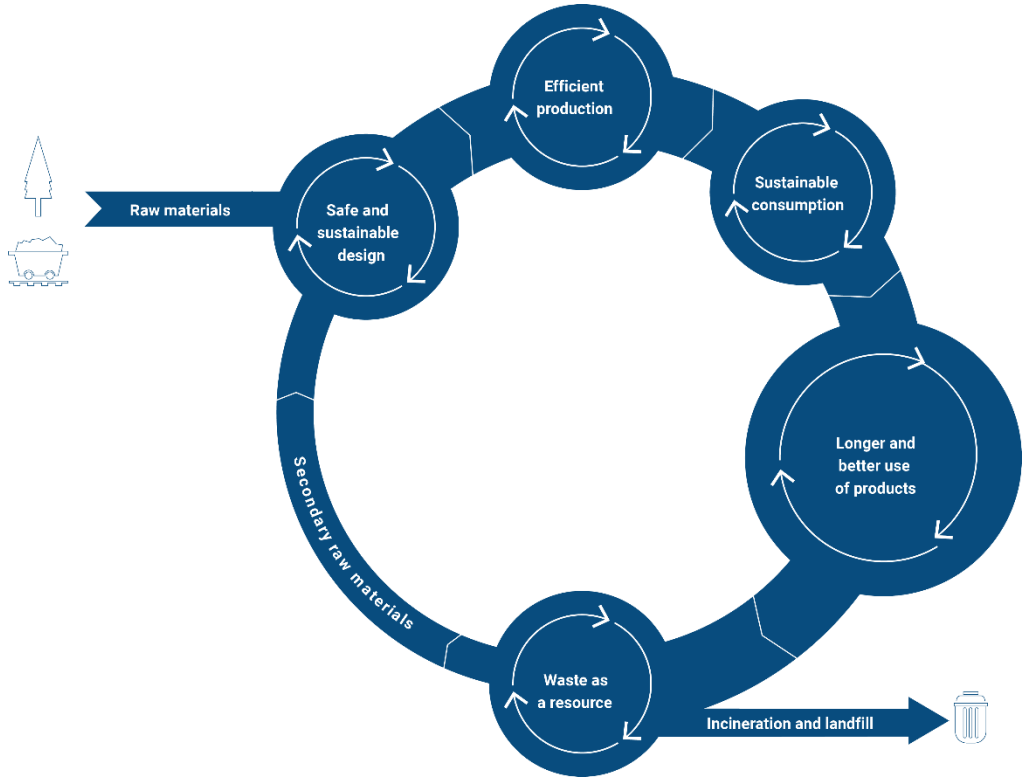

Figure 2: The circular economy model for sustainable value chains (Source: EEA 2024)

Through this project, we aim to address the complexities associated with textile and plastic waste in the Alpine Region. This intends to leverage stakeholder collaboration to innovate solutions and improve resource management, and create a more sustainable framework for future generations in the long term. By focusing on these interconnected issues, the project targets a comprehensive strategy that not only mitigates waste but also promotes a circular economy that benefits both the environment and the local communities dependent on these vital industries.

This report aims to provide an overview of the current status and developments within the topics of circular economy, textile production, and R-facilitators. In addition to this report, the

first work package includes five further reports that provide complementary information and deeper insights into the ASTER project. An input paper on R-strategies offers definitions and guidance on understanding and applying these strategies to project activities. Other deliverables focus on mapping key contextual factors in the Alpine region, such as economic flows and gaps, relevant regulations and economic policies for waste prevention and management, and institutional dynamics. Additionally, one report including two Deliverables analyzes the R-potential, waste generation, and waste management of outdoor products in the Alpine region. These reports provide an important empirical basis for assessing circular economy opportunities within the project.

CIRCULAR ECONOMY IN TEXTILE VALUE CHAINS

Circularity and Circular Economy

Within the European Union, the transition to a circular economy is considered vital for the EU's sustainable, low-carbon, and resource-efficient goals. With the Green Deal, the European Commission aims to extend the value of products and minimize waste, enhancing competitiveness by protecting businesses from resource scarcity and fostering job creation across skill levels (EC 2019). This policy shift aligns with EU priorities like job creation, climate action, and sustainable development, relying on the active participation of businesses, consumers, and various authorities (EC 2015). EU long-term plans, such as the European Green Deal or the Circular Economy Action Plan (CEAP), set waste reduction targets and implement strategies by 2050, with milestones, e.g., in 2030, or to promote recycling and reuse (EC 2019; EC 2020). Legislative measures, like the Extended Producer Responsibility (EPR) are meant to guide Member States towards best practices, stimulate investment in waste management, and improve producer responsibility schemes (EC 2022). Overall, EU-level actions aim to create an environment of innovation and stakeholder engagement, ensuring a successful transition to a circular economy. This is also reflected in a large number of European funding projects in transnational and cross-border cooperation. In recent funding periods, the Interreg Alpine Space Program (ASP) has focused in particular on the sectors of food (e.g., AlpFoodway[1]), wood (e.g., Forest EcoValue[2]), construction (e.g., BAUHALPS[3]), and textiles (e.g., AlpTextyles[4]).

In scientific debates, circular economy is discussed in different sectors in the last years. Textiles, food, or circular building are just few meaningful examples (Winquist et al. 2023; Elmqvist et al. 2019). Studies address multiple perspectives that have to be taken into account when it comes to circular economy, such as the role of business-models, technical, and social innovation (Coscieme et al. 2022) or the economic and environmental effectiveness of textile fibers recycling (Duhoux et al. 2021). Others take a more controversial view on circular economy. Gregson et al. (2015) complain, that the public and also scientific community is more into pushing the advantages of CE than make it subject to critical scrutiny. In terms of barriers in value chains, Corvellec et al. (2022) identify structural constraints to circular economy when connecting waste streams to production and substituting primary raw materials with secondary raw materials.

[1] https://www.alpine-space.eu/project/alpfoodway/
[2] https://www.alpine-space.eu/project/forest-ecovalue/
[3] https://www.alpine-space.eu/project/bauhalps/
[4] https://www.alpine-space.eu/project/alptextyles/

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The ASTER project understands the concept of circular economy in the sense of the United Nations Environment Programme (UNEP). It provides a circularity approach based on “value retention loops” (UNEP 2026) following the guiding principle *reduce by design*. This premise focuses on creating products and services that require fewer materials throughout their lifecycle. However, definitions are multifaceted and are addressed a lot in science, policy but also in practice. Critics rightly claim that the concept and its principles have changing definitions in different contexts (Kirchherr et al. 2017; Wardeberg et al. 2024). This is explained in more detail in the input paper on R-strategies and their use in ASTER and shortly summarized in the next section (Lambracht et al. 2025).

R-Strategies

The ASTER project focuses on the textile sector, particularly outdoor products, and follows a 10R approach to promote circularity, as outlined by researchers like Schnatmann et al. (2023) or Schimper (2025). Nevertheless, this approach is applicable to various sectors, including plastics. Schimper's comprehensive overview of the textile production chain underscores the importance of an effective collection system for used textiles and sorting capacities to facilitate circular production streams. Currently, textile production is primarily linear, emphasizing the need to expand product lifespans (Lambracht et al. 2025).

The 10R framework includes strategies for **smarter product use and manufacturing** (R0 Refuse; R1 Rethink; R2 Reduce), to **expand lifespans of products and parts (**R3 Reuse; R4 Repair; R5 Refurbish; R6 Remanufacture; R7 Repurpose), and in terms of **recycling** (R8 Recycling; R9 Recovery). This multi-faceted approach aims to enhance sustainability in the textile industry and transition towards a more circular economy. Besides the R-strategies, it needs facilitators who put the CE approach into daily life.

Traditional linear production chains refer to brands, including manufacturers, retailers, or wholesalers, and consumers, as well as waste collection operators. To increase circularity in textile value chains, it is necessary to include actors such as sorting and recycling operators, repairers, and reuse facilitators. With our findings, this report sheds light on the current status and distribution of these actors in the Alpine region.

METHODOLOGICAL NOTES

The work for this deliverable (D1.1.1) builds on extensive data research in the field of regionalized secondary statistics. In particular, the database of the European Statistical Office (Eurostat) and databases of national statistical offices were used as sources. Where necessary, these were supplemented or verified with information from sector reports.

These data availability challenges are resulting of two difficulties: First, there are significant differences in national classifications, particularly with regard to the circular economy and the related R-strategies. Also, Swiss classifications, in particular with regard to CE, cannot be combined with European classifications. Secondly, the geographical scope of the Interreg Alpine Space Program is a challenge in itself. In addition to entire nation states (Austria, Switzerland, Slovenia), other countries only participate through some of their regions (Bavaria, Northern Italy, and Western France). As a result, data at the national level cannot be fully utilized. In some sub-areas, however, a zoom-in approach makes it possible to approximate values.

Some European projects try to deal with these challenges, at least with the first one. The ESPON (European Observation Network for Territorial Development and Cohesion) project CIRCTER[5] (Circular Economy and Territorial Consequences) provides data on the territorial dimension of the transition towards a CE in Europe. Cartographic visualizations of these data help to identify regional patterns and flows of materials, including resources and waste. The analysis of the territorial dimension aims to uncover changes in resource use, design, production, distribution, consumption and waste management. These data were partially used and regionalized for to the Alpine region to get a general overview.

For all maps visualized in this report, the regional level – at least the NUTS-2 (Nomenclature of Territorial Units for Statistics) level – was aimed. This spatial resolution allows for differentiation at regional level and is the most suitable for the Alpine Space Program area in view of the data availability challenges.

MAPPING CIRCULAR ECONOMY IN THE ALPS

In total, four maps illustrate the spatial patterns of facilities involved in CE activities in the Alpine Space Perimeter. An overview of these four maps reveals a heterogeneous yet clearly regionally defined pattern encompassing infrastructural and business-related dimensions of the circular economy. The data used to develop the maps relates to CE in general and does not focus specifically on textiles and plastics. At the NUTS 2 level, clear differences among the regions emerge, indicating different institutional frameworks, economic structural conditions, and political priorities.

[5] https://www.espon.eu/projects/circter-circular-economy-and-territorial-consequences/

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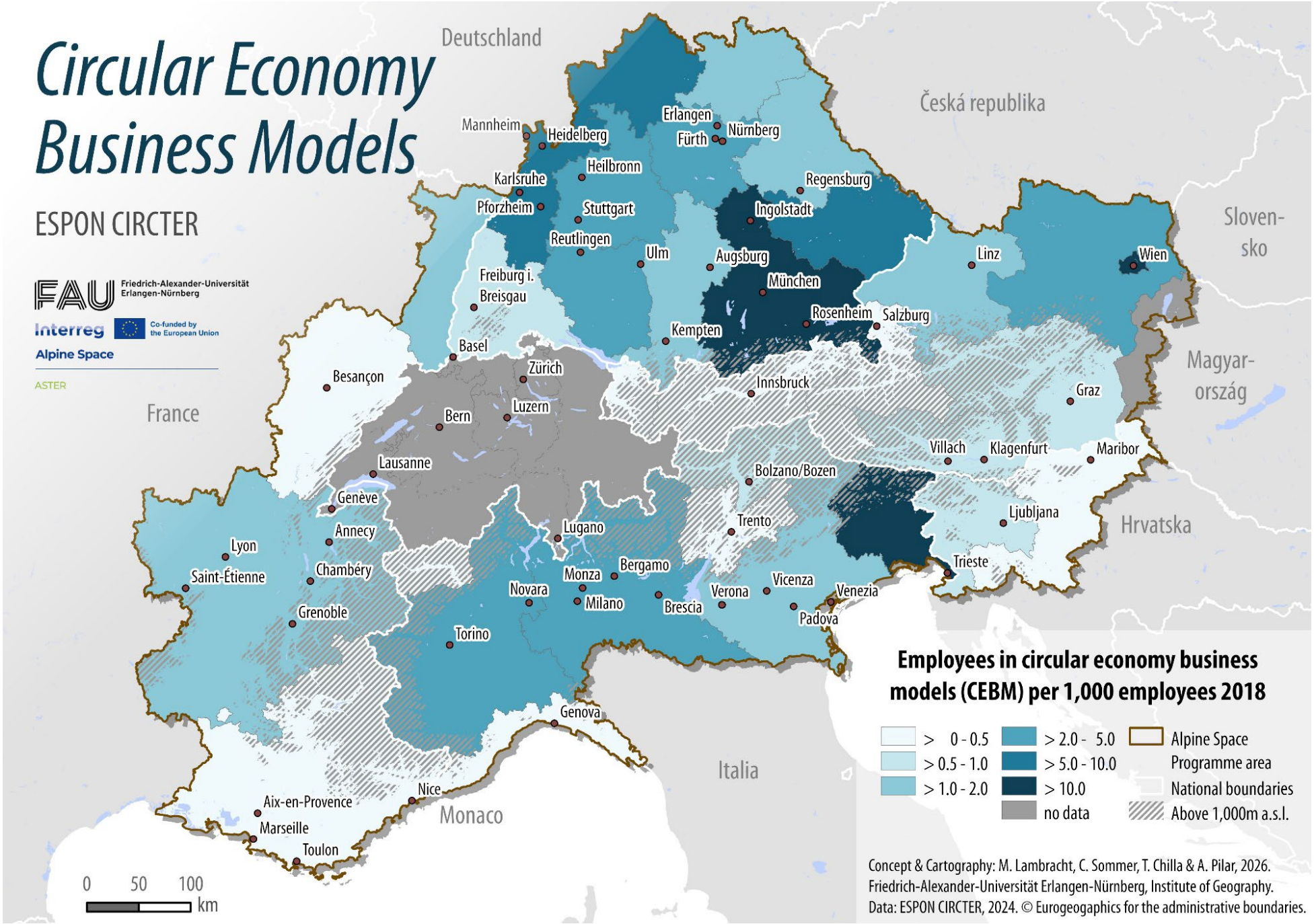

Figure 3: Circular Economy by Employment Relevance

Circular Economy by Employment Relevance

Figure 3 shows the proportion of employees in circular business models in the Alpine Space Perimeter (Interreg) in 2018. The data is based on the ESPON project, CIRCTER (2024), and was evaluated at the NUTS 2 level. However, no values are available for Switzerland in the underlying dataset, which limits spatial comparability across the entire perimeter.

The indicator “Employees in circular economy business models (CEBM) per 1,000 employees” measures the proportion of employees in companies with circular business models relative to 1,000 employees. According to the ESPON-CIRCTER project, CEBMs comprise economic activities based on circular economy principles, including repair, reuse, recycling, remanufacturing, sharing models, and product-service approaches to extending product life cycles. Thus, the indicator serves as a measure of the labor market significance of circular value creation within regional economic structures.

The spatial pattern reveals a heterogeneous overall picture with clear regional concentrations. Southern Bavaria has particularly high proportions of employees in CEBM. Additionally, southern Germany as a whole, northeastern Austria, the Vienna metropolitan area, and northwestern Italy exhibit elevated values. This distribution suggests that circular economy activities are more strongly anchored in economically strong, industrialized regions.

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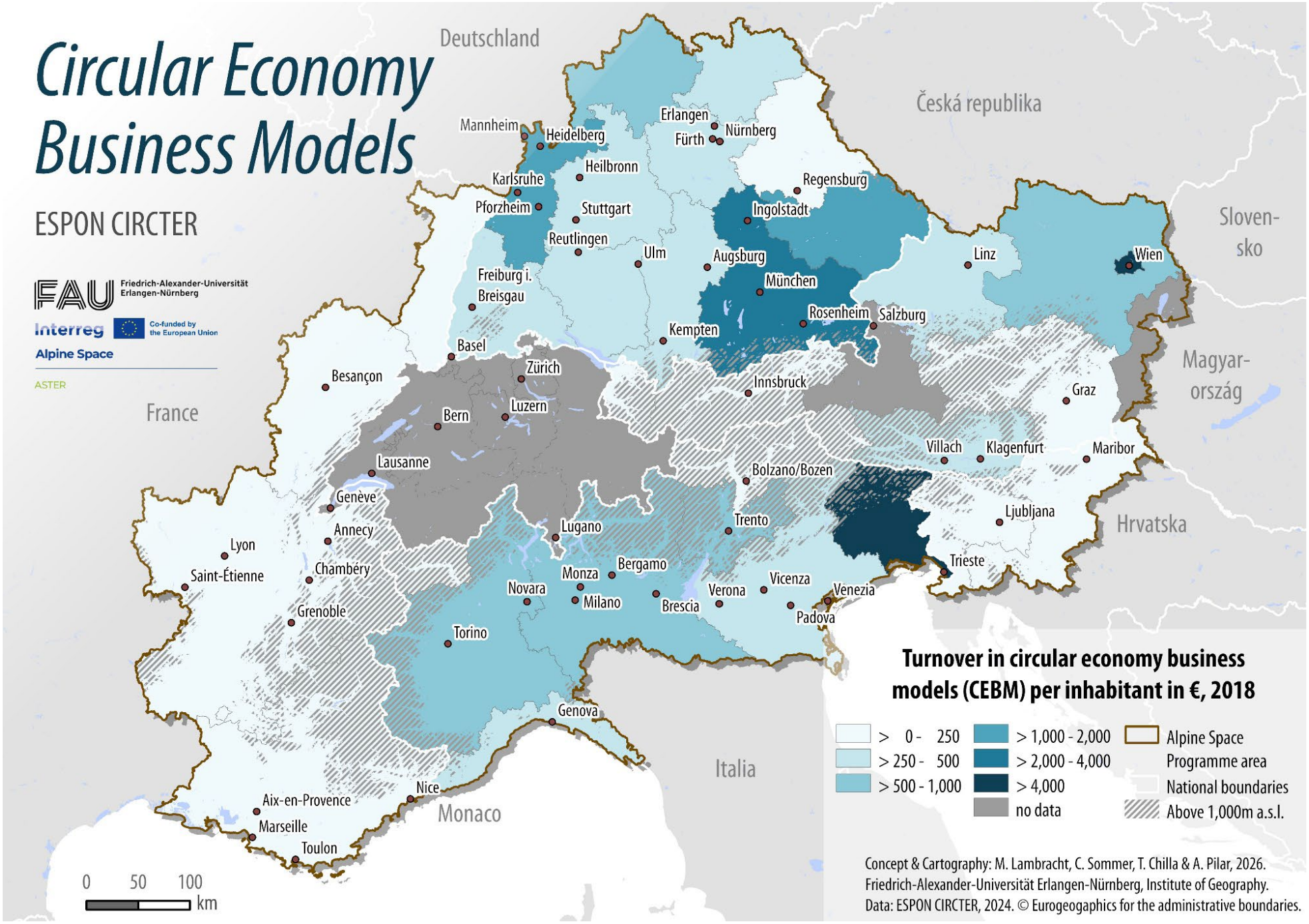

Figure 4: Circular Economy by turnover

Circular Economy by turnover

Figure 4 shows the per capita turnover of CEBMs in the Alpine Space Perimeter (Interreg) in 2018. The data is based also on the ESPON-CIRCTER project and is presented at the NUTS 2 level. However, no data is available for Switzerland or the Salzburg and Burgenland regions, which limits the spatial completeness of the analysis.

The indicator “Turnover in circular economy business models (CEBM) per inhabitant in Euros” measures the turnover of circular business models per inhabitant, serving as a measure of the economic significance of circular economy activities in a regional context. Within the ESPON-CIRCTER project framework, CEBM includes economic activities based on circular economy principles, such as repair, reuse, recycling, remanufacturing, sharing, and product-service business models that extend product life cycles. Therefore, the indicator reflects not only the existence of such companies but also their value added per capita.

The spatial pattern reveals a highly differentiated overall picture. Particularly high per capita sales are concentrated in southern Bavaria (Germany), Vienna (Austria), and Friuli-Venezia Giulia (Italy). Additionally, Lower Bavaria, Northeastern Austria, and Northwestern Italy exhibit elevated values. In contrast, sales figures are generally lower across France, which may indicate differences in sectoral structures, market sizes, or political support frameworks. Overall, the results underscore the critical role of national and regional contexts in circular value creation, as regulatory frameworks, support strategies, and economic structural conditions significantly impact regional characteristics.

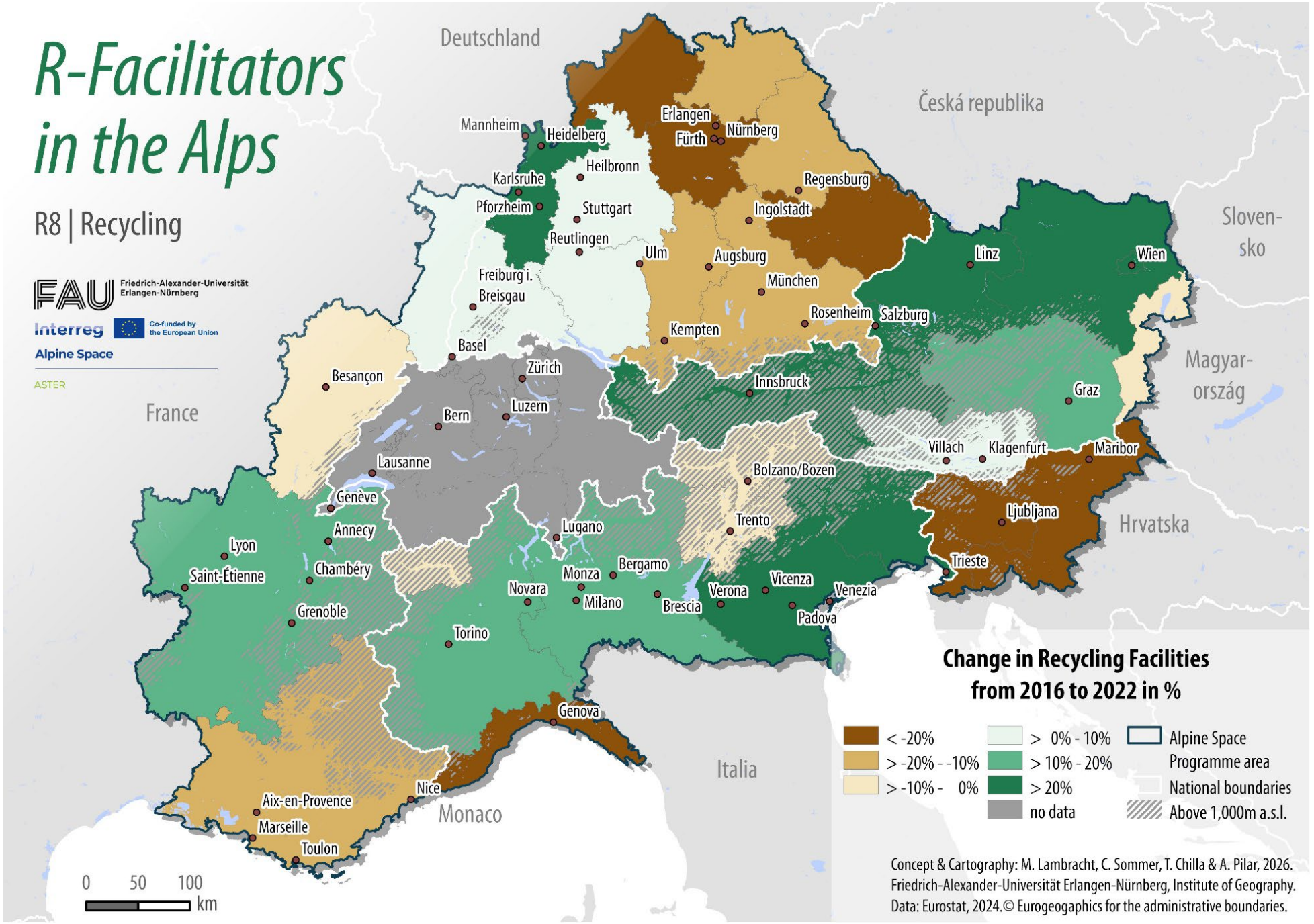

Figure 5: Recycling facilitators (R8)

Recycling facilitators (R8)

Figure 5 shows the percentage change in Recycling Facilities (R8) from 2016 to 2022 within the Alpine Space perimeter (Interreg). The data is based on Eurostat data from 2024, and the analysis was carried out at the NUTS 2 level.

The indicator, “Change in Recycling Facilities from 2016 to 2022 in percent,” measures the relative change in the number of recycling facilities, reflecting infrastructural dynamics in material recycling. In this dataset, ‘Recycling Facilities’ are defined according to waste treatment operations under the Waste Framework Directive. This includes material recycling facilities (e.g., paper, glass, metals, and plastics), composting or fermentation facilities for organic waste, sorting and processing facilities for recyclable materials, and facilities for reprocessing certain types of waste (e.g., metal or plastic recycling). These facilities are a central component of the circular economy because they enable materials to be returned to the economic cycle. This contributes to resource conservation and reduces the demand for primary raw materials. Changes in their number are closely linked to regulatory frameworks, investment cycles, technological innovations, and national and European CE targets.

Overall, the spatial pattern shows significant heterogeneity, with no uniform large-scale gradient. Significant concentrations of positive changes are found in the Karlsruhe region (Germany), Northeastern Austria, Northern Italy, and Central-Western France. In contrast, Bavaria (Germany) exhibits a notably high rate of decline, potentially indicating structural consolidation, greater efficiency through larger facilities, or shifts in waste disposal strategies. Overall, the results underscore the importance of the national context, as legal requirements, funding instruments, and economic structural conditions significantly influence the development of recycling capacities.

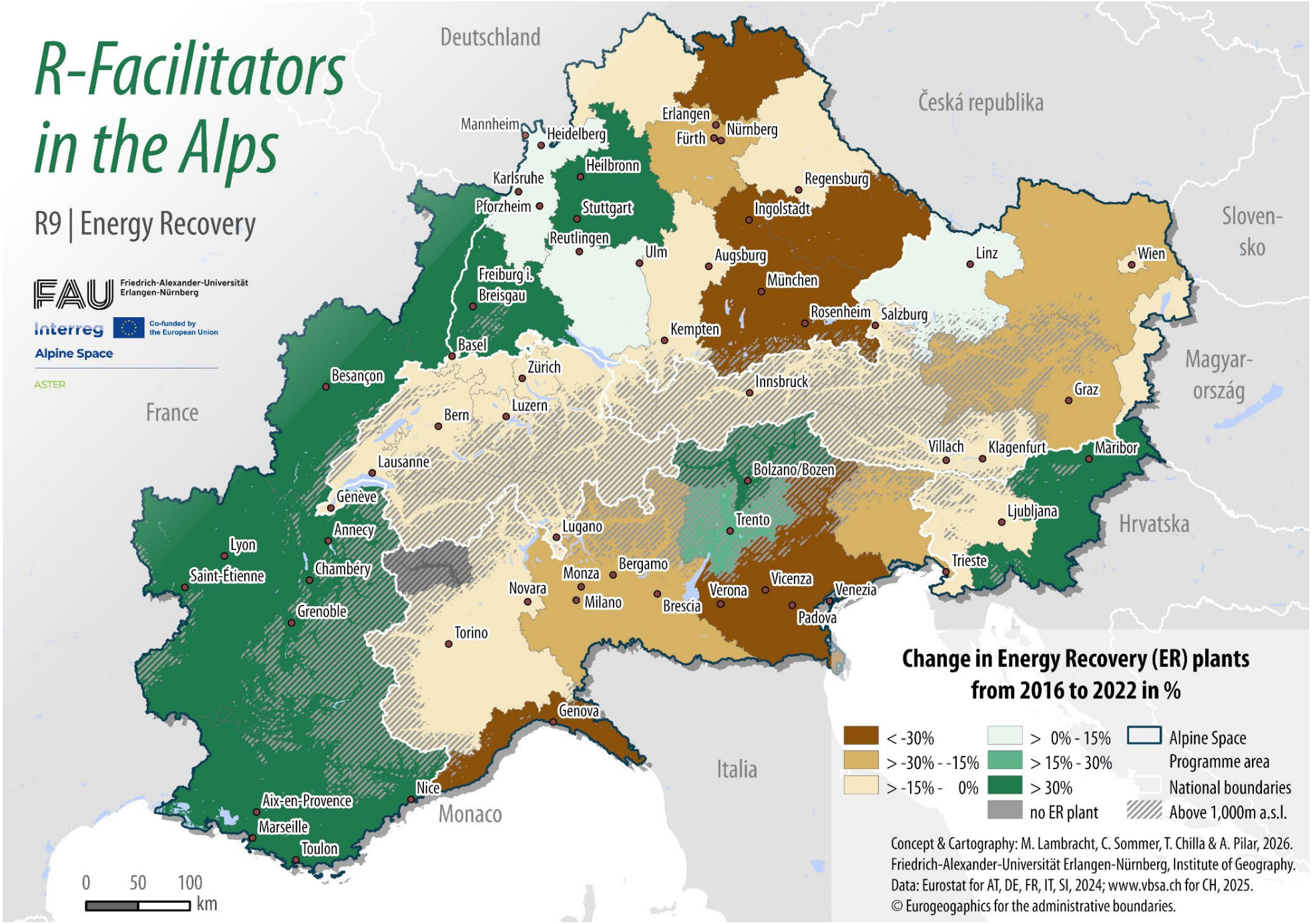

Figure 6: Energy Recovery Plants (R9)

Energy Recovery Plants (R9)

Figure 6 illustrates the relative change in energy recovery facilities in percent (R9 Energy Recovery) within the Alpine Space Perimeter (Interreg) from 2016 to 2022. The analysis was conducted at the NUTS 2 level and is based on Eurostat data from 2024 for Austria, Germany, France, Italy, and Slovenia, as well as on data from the VBSA[6] (Association of Swiss Waste Treatment Plant Operators) from 2025 for Switzerland. To give some more context, Table 2 shows the total numbers of recovery facilities for 2016 and 2022. This helps analyze whether an increase means the proportion of waste sent to landfills is decreasing and the proportion of waste incinerated is increasing, which would require further investigation. However, a reduction could also indicate a positive change, such as a decrease in the proportion of waste incinerated as the proportion of recycled waste increases.

The indicator “Change in Energy Recovery (ER) plants in percent” measures the relative change in the number of R9 plants, reflecting infrastructural dynamics in energy recovery from waste. Energy recovery plants are part of the waste hierarchy and serve to recover energy from waste that cannot be recycled further. The development of these plants is closely linked to national regulations, landfill bans, capacity adjustments, and energy and climate policy objectives.

The spatial pattern reveals an overall heterogeneous landscape with a tendency toward west-east differentiation. Pronounced growth is particularly evident in the Stuttgart and Freiburg regions (Germany), France as a whole, and Slovenia. In contrast, Bavaria (Germany) and parts of northern Italy exhibit strikingly high rates of decline. In Switzerland and Austria, low to moderate declines predominate. Overall, the results underscore the importance of the national context, as legal frameworks, funding instruments, and energy policy strategies significantly influence infrastructure development in the field of energy recovery.

Summary

The following points can be summarized for the regions in the Alpine Space area:

Within Southern Germany, the situation is rather complex. The Stuttgart, Freiburg, and Karlsruhe regions of Baden-Württemberg are showing significant growth in energy recovery facilities (R9) and the expansion of recycling infrastructure (R8). In contrast, Bavaria stands out with contrasting developments. While it has comparatively high employment and high per capita sales in circular business models (CEBM), especially in southern Bavaria, there are clear signs of decline in energy recovery and recycling.

Similarly, Austria exhibits functional differentiation to a certain extent. Northeastern Austria and the Vienna region have higher employment rates and revenues in circular economy business models (CEBM), and positive changes are evident in the recycling sector (R8). In contrast, trends in energy recovery (R9) are characterized by low to moderate declines.

Northern Italy, especially northwestern Italy and the region of Friuli-Venezia Giulia, show increased CEBM employment and turnover values, as well as positive recycling sector developments. However, declines in energy recovery plants can be observed in parts of northern Italy.

[6] https://vbsa.ch/

France is a special case. Although significant growth in energy recovery can be seen throughout the country, some regions (e.g., Auvergne-Rhône-Alps region and Alsace) are also showing positive momentum in the recycling sector. However, employment and turnover figures in CEBM remain comparatively low.

Slovenia shows growth in energy recovery but is less prominent in company-related CEBM indicators. Due to a lack of data in the CEBM maps and limited infrastructure information, Switzerland can only be classified in comparative terms to a limited extent, showing rather stable to slightly declining developments in energy recovery.

Overall, three trends can be identified. First, there is no single center of circularity; rather, there are different regional specializations between infrastructure-based (R8/R9) and business-based (CEBM) circularity. Second, economically strong industrial regions, particularly in southern Germany, northeastern Austria, and northern Italy, have a high concentration of value-added circular business models. Third, differences between countries highlight the importance of the national context because regulatory requirements, subsidy regimes, and energy policy strategies largely determine whether circularity is organized primarily at the infrastructure or enterprise level.

MAPPING THE TEXTILE INDUSTRY IN THE ALPS

An overview of the four maps depicting the structure and dynamics of the textile (NACE C-13) and clothing (NACE C-14) sectors in the Alpine Space region reveals nuanced patterns of structural specialization and sectoral transformation. NACE C13 refers to the manufacture of textiles, which includes activities such as spinning fibers into yarn, weaving or knitting fabrics, and finishing textiles through processes like bleaching, dyeing, and printing. It also covers the production of various textile products such as carpets, ropes, and household textiles. NACE C14, in contrast, refers to the manufacture of wearing apparel, meaning the production of finished clothing items such as shirts, trousers, dresses, and coats. These activities primarily involve cutting and sewing fabrics or other materials into garments. Thus, C13 represents the production of textile materials, while C14 refers to the manufacturing of finished clothing products. At the NUTS 2 level, stable spatial concentrations and distinct national development trajectories emerge.

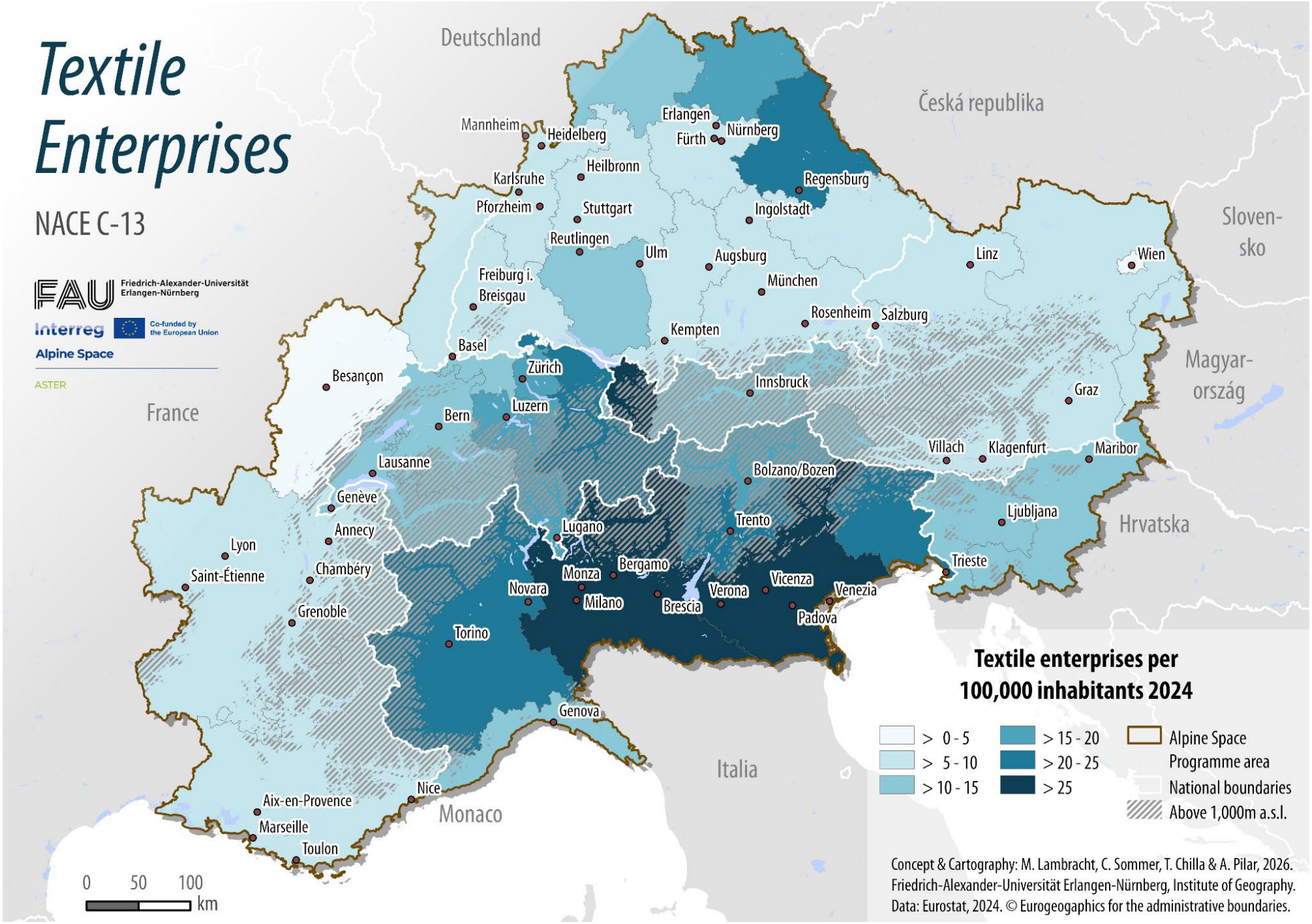

Figure 7: Manufacture of textiles by number of businesses

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Manufacture of textiles by number of businesses

Figure 7 illustrates the spatial distribution of textile companies (NACE C-13) within the Alpine Space Perimeter (INTERREG ASP). The data is based on Eurostat data from 2024 and evaluated at the NUTS 2 level.

The indicator, “Textile enterprises per 100,000 inhabitants,” measures the density of textile companies relative to the population. This allows for a standardized comparison of regions of different sizes. As a structural indicator, it provides information on regional specialization patterns and the importance of the textile industry within the respective economic structure.

The map shows an overall south-north divide, with southern regions tending to have higher enterprise densities. The concentration in Northern Italy is particularly pronounced. Additionally, elevated values occur in northeastern Bavaria (Germany) and parts of Northern Switzerland. These isolated exceptions illustrate that large-scale location, national framework conditions, industrial policy strategies, and historically grown specialization significantly influence the spatial distribution of the textile sector in addition to the general gradient pattern.

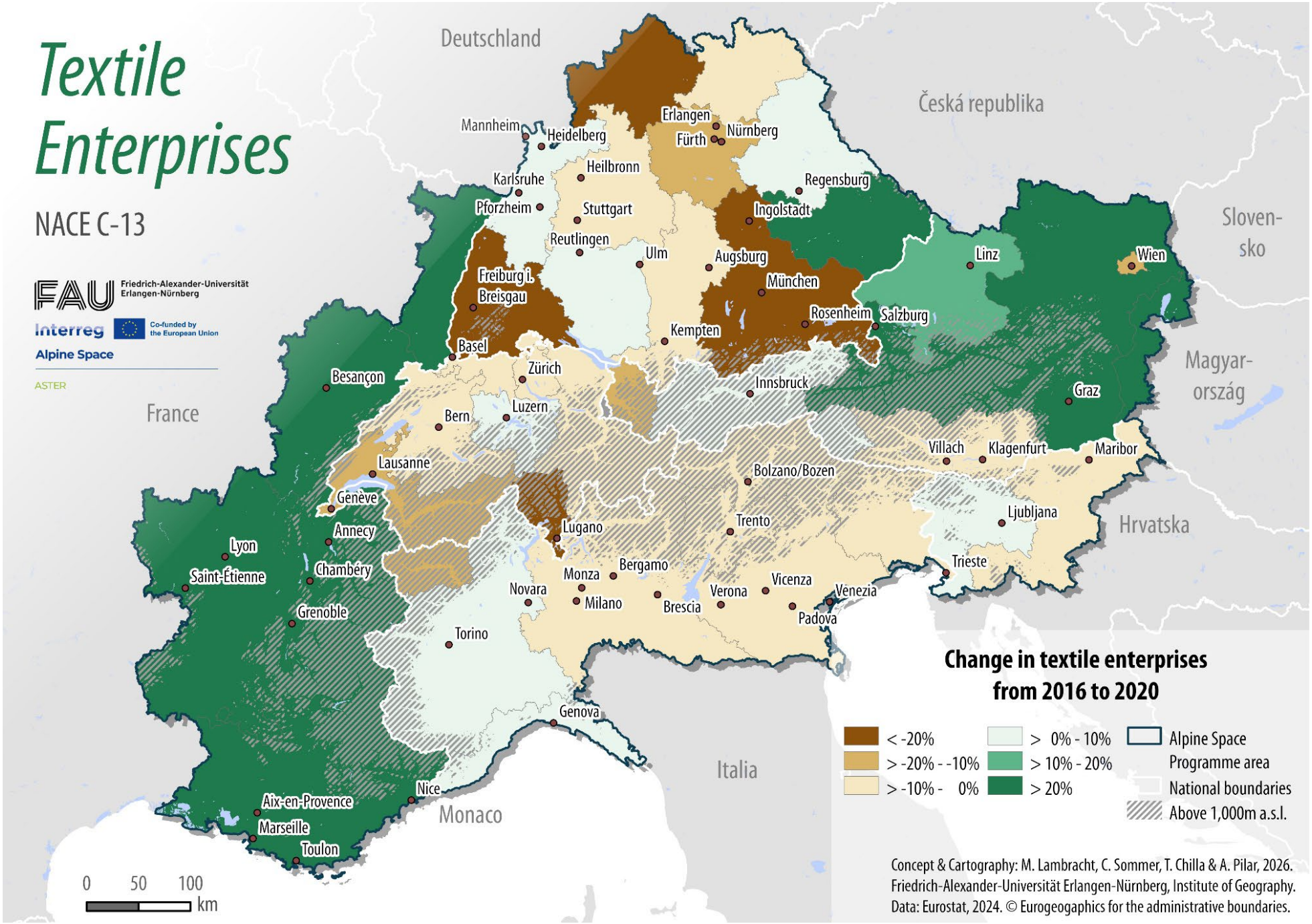

Figure 8: Manufacture of textiles by change between 2016 to 2020

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Manufacture of textiles by change between 2016 to 2020

Figure 8 illustrates the changes in textile companies within the Alpine Space Perimeter (Interreg) from 2016 to 2020. The evaluation is conducted at the NUTS 2 level and is based on Eurostat database data from 2024.

The indicator “Change in textile enterprises from 2016 to 2020” shows the percentage change in textile companies (NACE C-13) during the specified time period. Therefore, it does not reflect structural density, but rather sectoral dynamics. This allows to draw conclusions about adaptation processes, restructuring, and possible growth or contraction trends.

The spatial pattern reveals an overall heterogeneous picture without any clearly dominant large-scale gradients. Notable concentrations of positive or stronger changes appear in Western France and Northeastern Austria. In contrast, Southern Germany, Italy, Switzerland, and Slovenia show comparatively low rates of change, and Germany shows more pronounced trends toward decline. These findings underscore the importance of the national context because institutional frameworks, labor market structures, competitiveness, and integration into international value chains significantly influence sectoral development dynamics.

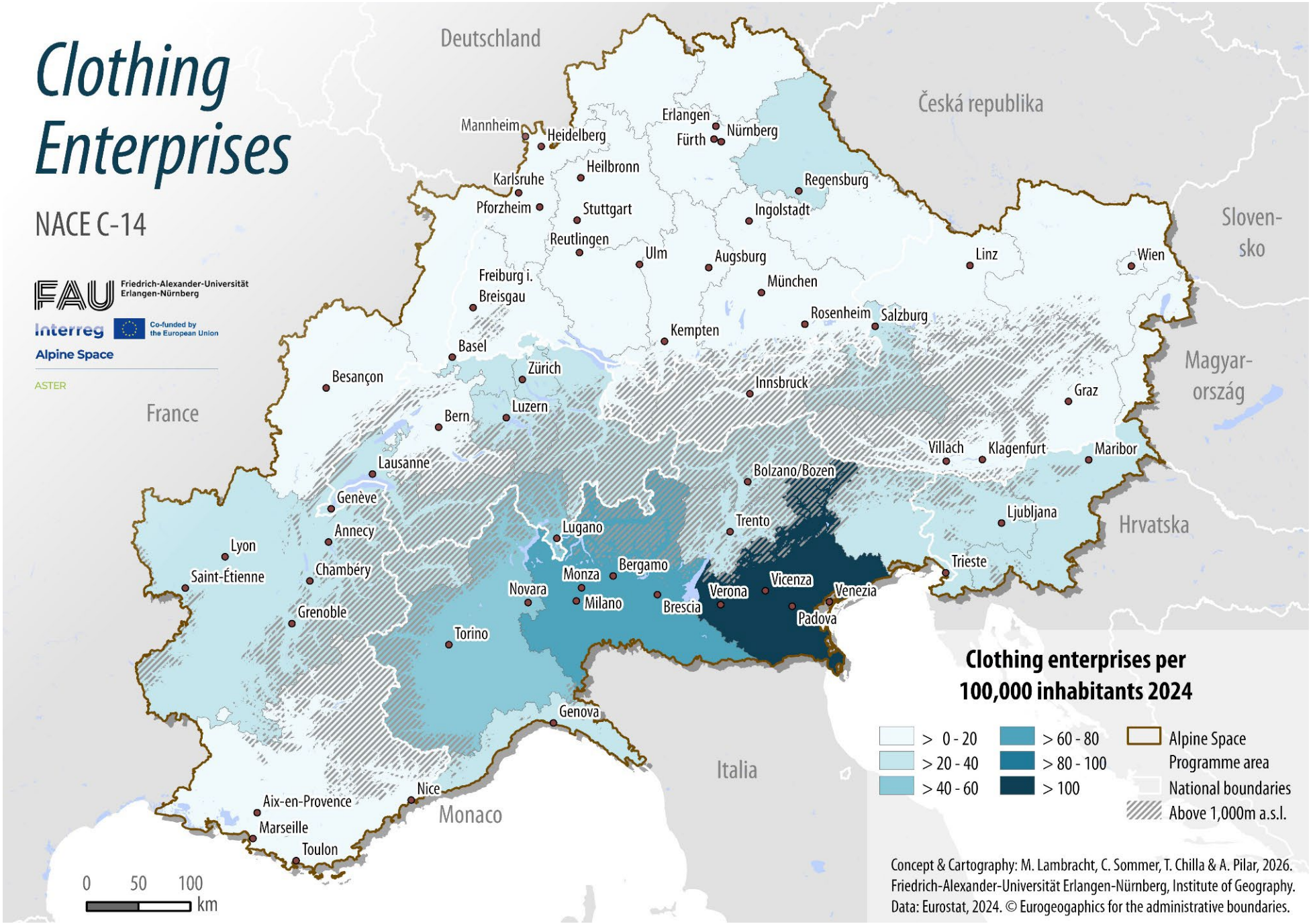

Figure 9: Manufacture of clothing by number of businesses

Manufacture of clothing by number of businesses

Figure 9 shows clothing companies and is based on the 2024 indicator “Clothing enterprises per 100,000 inhabitants.” The data is based on the most recent information available in the Eurostat database. The spatial scope of the study covers the Alpine Space Perimeter (Interreg) and is presented at the NUTS 2 level.

This indicator measures the number of clothing companies relative to the population size, serving as a metric for entrepreneurial density in the clothing production sector (NACE C-14). Standardizing the data per 100,000 inhabitants enables better comparability between regions of different sizes.

The maps reveal a significant south-north divide within the study area. Particularly high values are concentrated in northern Italy. In contrast, the northernmost parts of the Alpine region have significantly lower business densities. These spatial patterns highlight the importance of the national and regional economic context because institutional framework conditions, industrial policy strategies, and traditional specialization significantly influence spatial distribution.

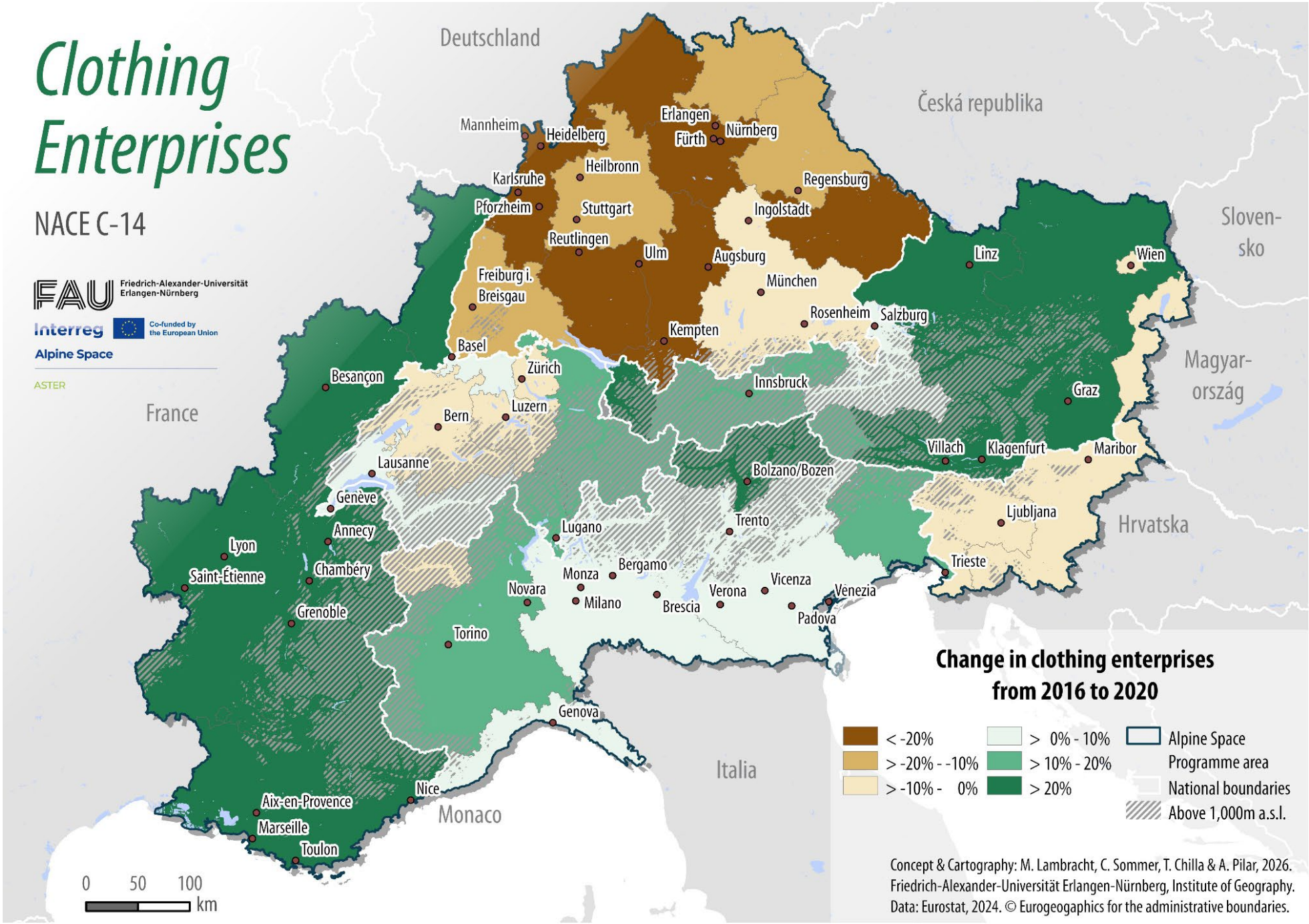

Figure 10: Manufacture of clothing by change between 2016 to 2020

Manufacture of clothing by change between 2016 to 2020

Figure 10 illustrates the changes in clothing companies within the Alpine Space Perimeter (Interreg) from 2016 to 2020. The evaluation is conducted at the NUTS 2 level and is based on Eurostat database data from 2024.

The indicator “Change in clothing enterprises from 2016 to 2020” shows the percentage change in clothing companies (NACE C-13) during the specified time period. Therefore, it does not reflect structural density, but rather sectoral dynamics. It allows one to draw conclusions about adaptation processes, restructuring, and possible growth or contraction trends.

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Summary

The following points can be summarized for the regions in the Alpine Space area based on the four maps:

A large-scale comparison reveals a clear South-North divide; the southern parts of the Alpine region have higher densities of textile enterprises than the northern regions. However, there are isolated exceptions to this general pattern in the textile sector in northeastern Bavaria and parts of northern Switzerland. These areas have specialized production and are traditional locations. Northern Italy, in particular, occupies a prominent structural position. Its textile and clothing sectors have high company densities per 100,000 inhabitants.

From a dynamic perspective (2016–2020), the picture changes slightly. Northern Italy remains a strong textile region, but growth there – as well as in Switzerland and Slovenia – is relatively slow. In contrast, western France and northeastern Austria show stronger growth in both sectors, indicating positive development trends.

Southern Germany has an ambivalent profile. While the textile sector shows slight positive momentum in some areas and a pronounced tendency toward decline in others, the clothing sector experiences widespread, very pronounced decline.

Overall, three key trends can be identified. First, a confirmed structural south-north divide exists, with northern Italy occupying a strong position as the traditional heartland of the textile and clothing industry. Second, regions experiencing strong growth (e.g., western France and northeastern Austria) are not necessarily the same as the traditional strongholds of the industry, indicating a spatial decoupling. Third, the maps reflect the strong relevance of the national context: labor costs, industrial policy strategies, subsidy regimes, and integration into global production networks influence the structural distribution and transformation dynamics of the textile and clothing industry in the Alpine region.

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MAPPING THE OUTDOOR AND SPORTS INDUSTRY IN THE ALPS

The challenges in terms of data availability allowed for only one map representing the outdoor and sports industry in the European Alps. To get a more detailed understanding of the different classification systems, some of the data mismatches need to be specified.

First, according to Eurostat (2008) the regional data in the NACE classification are only available for the first two digits, meaning the Department and group – this means higher-level categories. And second, other data classifications like the United States (US) Data Corporation Standard Industrial Classification (SIC) 8 Digit Code are able to deliver data with a higher sectoral resolution. This classification allows to filter for specific classifications within the Dun and Bradstreet (D&B) Hoover database. This database contains information on single enterprises and enterprise locations, but has limited access due to high user costs. Table 1 in the Annex shows all NACE and corresponding SIC codes.

The example in Figure 11 shows the difficulties quite clearly:

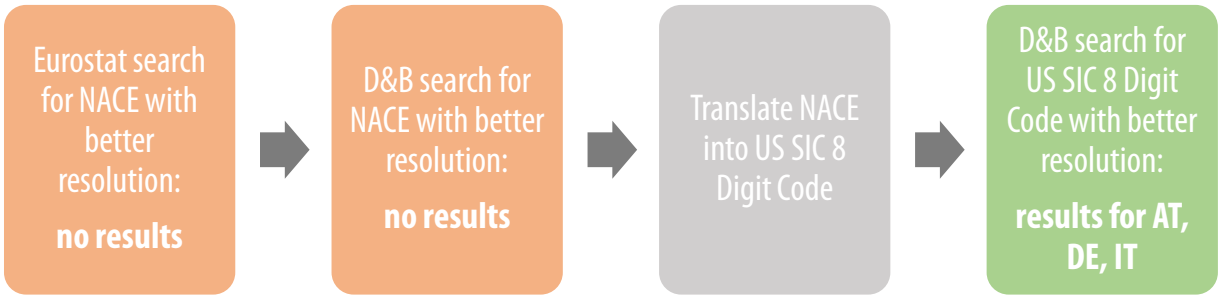

Figure 11: Search flow in Eurostat and the D&B Hoover database

Afterwards, In the D&B Hoover database, all codes were filtered for each NUTS2 region within the Alpine Space perimeter. Only results for Austria, Germany, and Italy were identified and downloaded. These results were then combined with the Eurostat data in the NACE classification C-14. The following visualization illustrates this in further detail.

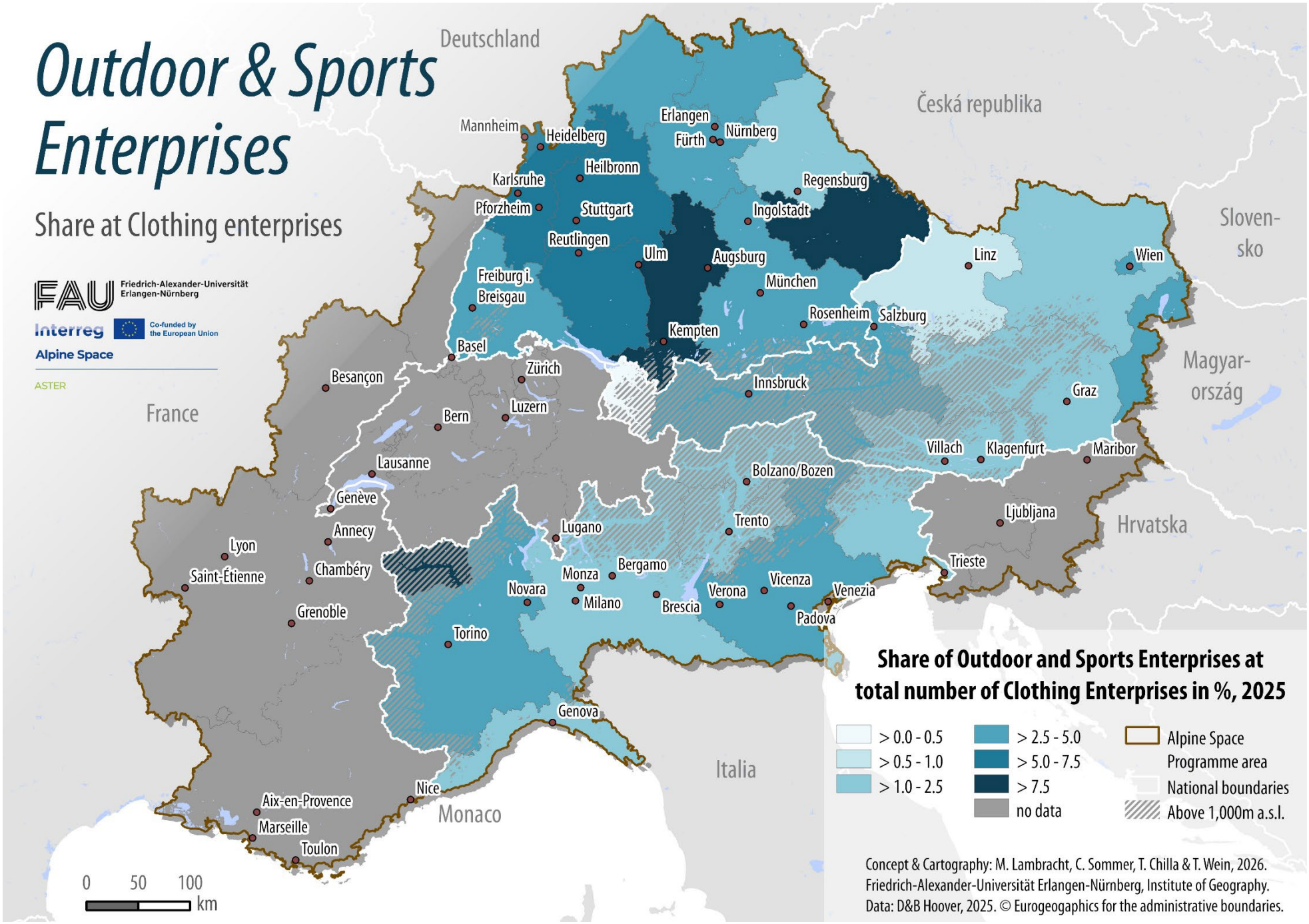

Figure 12: Share of Outdoor and Sports Enterprises at total number of Clothing Enterprises

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Outdoor and Sports Industry by businesses

Figure 12 illustrates the share of Outdoor and Sports Enterprises at the total number of clothing companies within the Alpine Space Perimeter (Interreg) in 2025. The evaluation is conducted at the NUTS 2 level and is based on the Dun & Bradstreet Hoover database combined with Eurostat data from 2024.

The indicator shows the percentage share of “Outdoor and Sports companies” in the total clothing enterprises (NACE C-14). As already described in the section on methodological notes, data with a more detailed breakdown level are rare. Therefore, the US Data Corporation SIC 8 Digit Code was used to get closer to some inductive results. The map must be understood as being indicative that gives preliminary hints but is not complete or comparative.

Overall, only data for Austria, Germany, and Italy were available. The spatial patterns reveal a generally low share of outdoor and sports enterprises, from below 10 percent. Some regions like the Aosta valley in Italy as well as Lower Bavaria and Swabia (Bavaria) in Germany show a comparably high share. Also, Baden-Württemberg has a share of more than 5 percent. All other regions show a low share below 5 percent and some even below 2.5 percent.

FINDINGS AND DEVELOPMENT POTENTIALS

Challenges and potentials

The investigation into the circular economy reveals several key findings and development potentials that can guide future initiatives. Firstly, CEBMs predominantly concentrate within metropolitan areas, such as Vienna and Munich. This concentration signifies a potential shift in focus. Rural and less urbanized regions may be bypassed despite their significant potential for circular practices. Furthermore, the spatial distribution of these models exhibits diffuse patterns, indicating that while some regions are adopting circular approaches, others lag behind, suggesting a need for targeted outreach and support.

The national context plays a crucial role in shaping these business models, highlighting the influence of national policies and regulations. This observation raises pertinent questions about the effectiveness of existing frameworks and the necessity for harmonization across regions to foster a cohesive circular economy. The complexity of the data surrounding circular economy practices compounds these challenges. Current data is often inadequate or inconsistent, lacking common definitions, resolution, and completeness, thereby complicating analysis and decision-making processes.

Regarding R-facilitators, significant regional disparities emerge in the implementation of practices related to reuse (R3), recycling (R8), and recovery (R9). At present, these three strategies are recognized as the most relevant in economic terms within the context of circularity. However, the textile waste sector is under immense pressure due to external forces such as EPR, Design for Recycling Policy, and the rapid advancements of fast fashion. These pressures indicate a need for heightened awareness and the development of effective frameworks to facilitate circular practices in textiles.

Similar to the broader circular economy landscape, the impact of the national context on R-facilitators suggests that tailored policies may be required to enhance the efficacy of reuse and recycling strategies in different regions. Furthermore, the data situation remains partially complex, with many definitions and resolutions still in need of standardization. Addressing these inconsistencies will be crucial to fostering a robust understanding of the circular economy and its potential for economic development.

In summary, these findings highlight significant areas for development, including the importance of targeted policies, improved data collection and analysis, and the promotion of circular economy practices beyond metropolitan areas. By addressing these challenges, stakeholders can harness the potential of the circular economy to pave the way for sustainable economic growth and resource efficiency in diverse contexts.

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Take-away messages

1. **Standardization and improved data management:**

   Differences in statistical classifications affect the measurement of circular economy activities in the Alpine Space. Inconsistent and limited data availability remains a major challenge for comparative regional analyses. Also, the complexity of data related to circular economy practices hinders effective decision-making. Standardizing definitions and improving data collection processes are crucial for improving understanding of circularity and enabling policies that promote effective reuse, recycling, and recovery strategies across regions in the European Alps.

2. **Importance of the national and regional context:**

   The regional differences in the maps imply that national and regional policies play a role, even though they are not addressed in this report. European circular economy frameworks form the basis of national policies and regulations. However, the implementation of these policies in each country and region is the responsibility of national political decision-makers. In order to foster a circular economy, coordination of existing frameworks across regions ensures that all areas can effectively implement and benefit from circular practices.

3. **Circularity as a cross-regional challenge:**

   Circular economy activities in the Alpine Space are not concentrated in one core region, but rather, they reveal regional differences. Economically strong industrial areas, such as northern Italy, southern Germany, and northeastern Austria show a high concentration of circular economy business models. This may be due to generalization issues as our analysis was carried out at the regional level and did not operationalize the local perspective but is consistent with the density of textile and clothing enterprises. Additionally, rural areas of the Alpine region have a rich textile heritage and practices that contribute to circular economy initiatives. Targeted research, further outreach, and support are essential to embed into existing industrial structures and thereby valorize the circular economy's potential in urban industrial areas and less urbanized rural areas in the Alpine area.

Reference to other Deliverables

This work package consists, beside this report, of five other reports that provide additional information and deeper insights into the ASTER project:

- **Input paper on R-strategies | Definitions and Understanding. A guideline through the Activities:** Gives insights into different definitions in terms of R-Strategies and their use in ASTER (Link: https://www.alpine-space.eu/wp-content/uploads/2026/02/R-strategies-and-their-use-in-ASTER_V3.pdf).
- **Deliverable 1.1.2 | Mapping economic flows & gaps in the Alps:** coming soon.
- **Deliverable 1.2.1 | Regulations and economic policies for waste prevention and management in the Alps:** coming soon.
- **Deliverable 1.2.2 | Mapping institutional dynamics in the Alps:** coming soon.
- **Deliverable 1.3.1 & 1.3.2 | R-potential, waste generation, and waste management of Outdoor products in the Alpine region:** coming soon.

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ANNEX

This table contains the NACE and corresponding SIC codes for Outdoor and Sports Enterprises used in Figure 13.

Table 1: NACE and corresponding SIC Codes for Outdoor and Sports Enterprises

The NACE codes
141 Manufacture of clothing (excluding fur clothing)
1413 Manufacture of other outerwear
1419 Manufacture of other clothing and clothing accessories nec
have been translated into
23390300 Women's and misses' athletic clothing and sportswear
23290101 Athletic clothing, except uniforms: men's, youths' and boys'
23390301 Athletic clothing: women's, misses', and juniors'
23290100 Men's and boys' sportswear and athletic clothing
23390310 Sportswear, women's
23290104 Ski and snow clothing: men's and boys'
23290102 Bathing suits and swimwear: men's and boys'
23390302 Bathing suits: women's, misses', and juniors'
23390400 Women's and misses' jackets and coats, except sportswear
23290103 Riding clothes: men's, youths', and boys'
23890000 Apparel and accessories, nec
23390307 Ski jackets and pants: women's, misses', and juniors'
23390000 Women's and misses' outerwear, nec

This table provides an overview of existing Energy recovery plants in the region of the European Alps to supplement Figure 7.

Table 2: Number of Energy Recovery Plants per NUTS2 region

Country	Name	2016	2022
DE	Stuttgart	30	42
	Karlsruhe	20	23
	Freiburg	27	37
	Tübingen	27	29
	Oberbayern	74	47
	Niederbayern	38	21
	Oberpfalz	15	14
	Oberfranken	33	18
	Mittelfranken	29	21
	Unterfranken	28	24
	Schwaben	35	30
FR	Franche-Comté	2	3
	Alsace	2	4

	Auvergne-Rhône-Alpes	*10*	*15*
	Provence-Alpes-Côte d'Azur	*1*	*4*
IT	*Piemonte*	*41*	*35*
	Valle d'Aosta/Vallée d'Aoste	*0*	*0*
	Liguria	*6*	*3*
	Lombardia	*81*	*67*
	Provincia Autonoma di Bolzano/Bozen	*1*	*2*
	Provincia Autonoma di Trento	*5*	*6*
	Veneto	*69*	*45*
	Friuli-Venezia Giulia	*20*	*16*
	Emilia-Romagna	*47*	*45*
AT	*Burgenland*	*5*	*5*
	Niederösterreich	*14*	*11*
	Wien	*5*	*5*
	Kärnten	*9*	*9*
	Steiermark	*7*	*5*
	Oberösterreich	*17*	*19*
	Salzburg	*3*	*3*
	Tirol	*2*	*2*
	Vorarlberg	*1*	*1*
SI	*Vzhodna Slovenija*	*4*	*7*
	Zahodna Slovenija	*6*	*6*
CH	*Région lémanique*	*5*	*5*
	Espace Mittelland	*7*	*7*
	Nordwestschweiz	*4*	*4*
	Zürich	*6*	*6*
	Ostschweiz	*7*	*7*
	Zentralschweiz	*2*	*2*
	Ticino	*1*	*1*

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