

Potential land use impact of EU policies and global trends on the Netherlands

28.07.2023 / 2023-267

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REPORT



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List of abbreviations

Abbreviation	Full name
BBB	BoerBurgerBeweging (The Farmer–Citizen Movement)
BZK	Binnenlandse Zaken en Koninkrijksrelaties (Ministry of the Interior and Kingdom Relations)
CBS	Centraal Bureau voor de Statistiek
CEF	Connecting Europe Facility
COROP	Coördinatiecommissie Regionaal Onderzoeksprogramma,
EGD	European Green Deal
EU	European Union
GDP	Gross domestic product
JFCBS	Allied Joint Force Command Brunssum
LAU	Local administrative unit
NATO	North Atlantic Treaty Organisation
NUTS	Nomenclature of territorial units for statistics
PEEST	Political, economic, environmental, social and technological
QUAD	Quadrilateral Security Dialogue
TEN-E	Trans-European Networks for Energy
TENT-T	Trans-European Transport Network
US	United States
VVD	Volkspartij voor Vrijheid en Democratie (People's Party for Freedom and Democracy)



2 Executive summary

This research explores a selection of EU policies and global trends and their potential land use impact on five case studies in the Netherlands. The assumption behind the research design is that based on the scope and anticipated realisation of EU policies and occurrence of global trends, the potential land use impact can be estimated. The study uses a qualitative foresight methodology, incorporating the uncertainty of future-oriented investigations. The reasoning and the identified causal links rely on estimates pertaining to economy, social change, and political decisions, as well as environmental impacts and technological advancements. The land use impact estimates are derived from this reasoning and different levels of uncertainty. The study differentiates between expansive and restrictive potential land use impacts. Expansive land use means increased demand for a certain type of land. Restrictive means that as a result of the policy or trend, a certain type of land use may no longer be necessary or may be converted to another type. Land use impacts that have different effects on different territories or are difficult to estimate clearly are categorised as inconclusive. The analysed policies and trends suggest the following main anticipated effects:

- The European Green Deal and the policies aligned to it, such as the EU Circular Economy strategy and the EU Biodiversity strategy, may increase pressure on natural and agricultural areas, focusing on their potential expansion, especially for more sustainable agricultural practices, or on limiting their conversion. This can create challenges in agricultural areas as well as in areas closer to growing bigger cities that can increase the risk of conversion of nearby agricultural land.
- Land transport is expected to be a higher priority in the long term, together with potential changes in people's travel preferences. This can create more demand for transport land use, especially along main transport corridors. The expected economic growth of key industries can also fuel this expansion. Shorter supply chains in the circular economy may partially offset this expansion.
- The energy transition is also expected to trigger more demand for land allocation for renewable energy projects unless innovative solutions such as dual land use are explored. Large-scale projects can require significant amount of land. For cities this can be partially offset by utilising the available built environment and smaller scale solutions. Border regions can potentially offset this pressure through cross-border cooperation.
- Increased digitalisation can trigger behavioural change, with citizens spending more time at home due to more services being accessible from a distance. This can increase demand for residential land use. Different patterns can be expected here depending also on the advancement of the trend of working remotely – some territories may become more attractive than others. Digital divide may be experienced by different territories or sectors due to varying levels of accessibility or adaptability to increased digitalisation.
- Digitalisation, specifically semiconductor production is a high-level priority of the EU. This can trigger further expansion of industrial land use, especially in already established technological centres. The semiconductor industry also has geopolitical importance; therefore, it is more susceptible to global changes and other countries (such as the US and China).
- Events outside of the EU, such as new conflicts or geopolitical shifts, may increase migration pressure and, respectively, trigger increased demand for residential land use, disproportionately affecting bigger cities (due to perceived better opportunities there).



- Further cross-territorial and intra-territorial inequalities can worsen due to the disproportionate effects of the overlapping policies and trends on different territories. More proactive role of planning and policy will be needed on national level.

The main potential impacts on the selected case studies can be summarised as follows:

- Potential conflicts between land use types may arise in regions with potential for industrial expansion and port infrastructure and high shares of agricultural and natural land use, such as Delfzijl en omgeving.
- The role of predominantly natural and agricultural regions, such as De Achterhoek, can differ at regional and national level. Increased use of technology, more organic production and new forms of agriculture can contribute to more efficient use of agricultural land. At national level, large shares of agricultural and natural land can contribute to national targets and achievement of carbon offset targets.
- Strategic ports and transport hubs as well as advanced technological and industrial centres, such as Rotterdam and Eindhoven, can experience further pressure to expand their industrial, transport and residential land use. As a result, there may be immediate land use conflicts with surrounding non-built land use. Counteracting this sprawl can lead to further densification and more compact forms of urban planning.
- More peripheral territories with specific characteristics and some potential for growth, such as Zuid-Limburg, can experience increased demand for expansion of transport and industrial land use. The cross-border context can offer both further opportunities for growth, but also offset some of the pressure on the territory.

In the context of the new spatial planning document Nota Ruimte, the more directing role of the central government appears to be a suitable approach, considering the regional differences but also attempting to achieve a more balanced development on national level. Such an approach could better address potential trade-offs, especially for natural and agricultural expansion and the built environment. The envisioned balanced development and considerations for quality of life ought to ensure proper provisioning of infrastructure and services in order to maintain the quality of life in different regions as well as more territorial sensitivity to potential local level decisions for land use conversion. Lastly, the anticipated effects from EU policies and global trends ought to be viewed in a broader European context, surpassing the boundaries of the Netherlands including a wider perspective concerning the effects on cohesion and the objectives of a future for all places outlined in the Territorial Agenda 2030 such as balanced territorial development, resilient communities and places and developing well-functioning and connected regions while balancing considerations for the impacts of climate change, living conditions and competitiveness.



3 Introduction

This study has been performed in the context of the discussions on the upcoming new spatial planning document Nota Ruimte of the Netherlands in 2023. The study addresses the main discussion question, namely: **How can different EU policies and global trends impact the land use in specific areas in the Netherlands?**

The study explores a selection of EU policies and global trends and their potential land use impact on five case studies in the Netherlands. The assumption behind the research is that based on the scope and anticipated realisation of EU policies and occurrence of global trends, the potential land use impact can be estimated. This idea is applied to case studies based on their land use characteristics (among others). The assumption is that these two steps will allow the tracing of the potential land use effects on these territories.

The study's tailor-made methodology is based on qualitative 'futuring' and foresight methods, incorporating the inherent uncertainty of future-oriented investigations. As a result, the line of reasoning and the identified causal links rely on estimates pertaining to economy, social change, and political decisions, as well as environmental impacts and technological advancements. The land use impact estimates are derived from this line of reasoning and different levels of uncertainty. The study focuses on anticipating the immediate potential effects of the identified policies and trends as well as on secondary 'follow up' effects. By limiting the reasoning to those two iterations, the study significantly reduces the risk of overspeculation. Still, due to the nature of the research design and the inability to fully predict the possible course of events, the research relies on informed judgement, based on multiple qualitative data sources. The conclusions intend to provide input for ongoing discussions on the strategic direction of spatial planning in the Netherlands rather than to outline certain and conclusive arguments on land use change.

This report provides inputs to a discussion on possible future land use impacts. It comes with some caveats.

Firstly, the future is uncertain and more likely to be shaped by disruptions than trend continuations. This is why more efforts are needed to discuss possible futures and increase the flexibility needed to respond to unexpected developments or unexpected effects of expected developments. This report needs to be seen in that light. The aim is not to provide information about the future, but to help discussing possible impacts of single trends and policies, which also need to be seen in a wider context of interrelations with other developments, trends, and policies.

Secondly, territorial foresight is a structured process that (a) focuses on long-term developments and their possible territorial impacts, (b) is based on lateral thinking in participative approaches and (c) provides support for decision-making processes. This study is only a first input to possible foresight process, providing first assessments of potential impacts. In a fully-fledged foresight process this would serve as starting point for the lateral thinking and actual foresight process.



Thirdly, the report has a strong focus the Netherlands. However, the trends and policies considered are of much larger European or global character. As such, also their impacts need to be understood in the context of mutual interdependencies of places at European or even global level. Taking the discussion one step further beyond pure land use issues, the change in land use and economic, social, and environmental activities in a place also affects developments and cohesion in a wider geographical context. This concerns cohesion – or balanced territorial development – both in the Netherlands and in Europe. Therefore, the discussion on possible land use might want to also include a wider perspective concerning the effects on cohesion and the objectives of a future for all places outlined in the Territorial Agenda 2030.

Section 4 of the report outlines the research design and methodology of the study. Section 5 of the report outlines the sectoral impact estimates and the land use impact estimates in a summarised form. Section 6 of the report presents the case study analysis and the potential land use impact on those areas. Section 7 summarises the conclusions of the report and how they refer to the current work on the new spatial planning document Nota Ruimte for the Netherlands.



4 Methodology

The research focuses on five EU policies and five global trends which have been selected by Spatial Foresight and BZK (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties) together. The potential land use impact of those policies and trends is illustrated with five case studies from the Netherlands, also selected by Spatial Foresight and BZK.

The analysis of the potential land use impact of EU policies and global trends has been structured in two phases. The first focuses on the land use impact analysis where the EU policies and global trends are reviewed separately to outline their potential impact. During this stage, the land use impact analysis is done on a general level, without specific territorial considerations. In the second stage, the analysis is applied to the five selected case studies in order to trace what the potential impact can be on the selected areas, including overlapping impacts.

Sources for the foresight analysis include different policy documents and strategic papers, research publications, other study reports and specialised media outlets. The sources are reviewed by the study team and inform the expert assessment.

4.1 Selection of EU policies and global trends

During the preparatory stage of the study, Spatial Foresight provided a list of 23 EU policies and 27 global trends to facilitate the selection. The list was prepared based on previous Spatial Foresight research into territorial scenarios (ESPON 2022), the adaptation of the EU and cohesion policy to disruptive events (Böhme et al. 2022) and development trends that can impact the EU (Böhme et al. 2021). The proposed EU policies and trends were grouped in different thematic blocs. Spatial Foresight provided indications on which EU policies and global trends may be suitable for analysis to ensure a diverse set of examples across different topics. In a meeting between Spatial Foresight and BZK held on 20 March 2023, the policies and trends were reviewed and discussed, resulting in the following selection:

○ EU Policies:

- European Green Deal (P1)
- EU Circular Economy Action Plan and Strategy (P2)
- EU Biodiversity Strategy (P3)
- Connecting Europe Facility (P4)
- Europe Fit for the Digital Age (P5)

○ Global trends:

- Increasing shift to renewables (T1)¹
- Working from anywhere (T2)²
- Accelerated digitalisation and omnichannel futures (T3)³

¹ <https://steadyhq.com/en/spatialforesight/posts/74877376-8fa7-4392-acf2-d91c17ee3eb0>

² <https://steadyhq.com/en/spatialforesight/posts/1acf923c-7c98-4d72-b8b8-10c55e93915f>

³ <https://steadyhq.com/en/spatialforesight/posts/81662208-b7b9-4956-b88d-9fe96b13042d>



- Global geostrategic plans of others (outside of Europe) (T4)⁴
- Tyranny of merit (T5)⁵

Following the analytical work on the EU policies and global trends, they were assigned indexes to facilitate a better structure for the study and trace interrelations between policies and trends in the cross-analysis.

4.2 Foresight methodology and land use impact estimate approach

The foresight methodology has been designed for this study. It incorporates elements from the “Futures wheel”(Jackson 2013) method, as well as other foresight methods to structure the analysis in categories that encompass the uncertainty, inherent in future-oriented research. The methodology consists of five main steps which are applied to each EU policy and trend. Each of the EU policies and global trends is described with overall typology and split into up to five policy objectives or trend elements prior to the analysis.

The **classification of EU policies and trends** places each in a broader thematic category, following the PEEST framework (political, economic, environmental, social, and technological). For each policy and trend the main “modus operandi” is defined – answering the question: How is the policy delivered or trend manifested? In addition, the estimated time horizon is added – for the EU policies this is usually specific, based on the policy documents while it is estimated for the trends. For each policy and trend, explanation on the selection of objectives and trend elements is provided in the analysis. As a last step, each EU policy and trend is split into up to five policy objectives or trend elements (See Annex 1). This split is based on the structure of the policies, usually outlined in the policy documents. For the trends, the trend elements are derived from the overall analysis of information for this study.

The **sectoral impact estimate** forms the foundation of the analysis. It is based on the “Futures wheel” method where consequences and effects are estimated across the five categories of the PEEST framework (political, economic, environmental, social, and technological). First, the expert assesses the immediate consequences of the achievement of the objectives (of the policy) or the realisation of the trend elements (of the trends). Thereafter, the expert assesses the subsequent consequences, that is – the secondary impacts, of the results of the first round. As a result, the sectoral impact estimates outline the expected effects from achieving the policy objectives or the occurrence of the global trends in two stages. Firstly, an expert evaluates the assigned policies and trends alone and provides estimates. After that, the estimates are reviewed in a workshop setting, with feedback and critical review from a senior expert. As a result, the sectoral impact for each policy and trend is defined in the form of a story narrative to facilitate the illustration of the effects. The sectoral impact estimates are the main analytical output that informs the land use impact estimate.

The **land use impact estimate** is based on the sectoral impact estimate. After the sectoral impact estimate is completed, the study team estimated how the potential sectoral effects (and as a whole for the policy and trend) can affect land use across the six land use categories (see 4.3.). Specific attention

⁴ <https://steadyhq.com/en/spatialforesight/posts/b4963117-0c50-42fe-94e1-11ba532bce97>

⁵ <https://steadyhq.com/en/spatialforesight/posts/f75c6801-ded7-401e-a0a9-31d0f23c02b9>



is paid to policy objectives, pertaining to land use (e.g., expansion of railway infrastructure suggests direct effects on *Transport* land use). In addition to the direct references, the sectoral impact estimates are interpreted from a land use perspective, considering territorial differences (e.g., growing vs lagging regions; urban vs. rural). The approach focuses on economy-driven effects (e.g., investments in a certain sector), public policy interventions (e.g., investment in telecom infrastructure), environmental effects (e.g., decrease of emissions) and behavioural changes (e.g., changed transport habits and needs). The causal interpretation of those effects is focused on potential land use impact, answering the research question ‘What are the potential effects on land use as a result of this change?’.

The land use impact estimates are informed by the main distinction between Expansive and Restrictive land use. Expansive land use suggests the policy or trend, requires more of a specific type of land (e.g., expansion of a certain industrial economic activity increases the demand for *Built-up area-Industrial area and offices*, thus the land use impact estimate is Expansive for this category). Restrictive land use suggests that as a result of the policy or trend, a certain type of land use may no longer be necessary, or it is at risk of being lost at the expense of another by being converted. For instance, the increase in construction of transport infrastructure may result in the need for acquiring more agricultural or natural land that can be converted into new roads or railways – this would result in a Restrictive land use impact estimate for *Agriculture* and *Woodland and nature* (and Expansive for *Transport*).

When the impact of a certain policy or trend impact a certain land use with different effects, the land use impact estimate indicates Inconclusive. This rating stipulates that the effects of the different objectives or trend elements may differ and impact on land use can be expected, but one score cannot be assigned. Thus, Inconclusive suggests that the effects are controversial, and may differ depending on the type of territory affected or on the effects on the land use. For instance, increased economic activity in a certain industry can benefit a city that is already a leader in the field and thus increase the demand for industrial land there, but it can have the reverse effects on a less developed region whose citizens may be more interested to migrate to the urban centre to find jobs. As a result, the land use impact can be expected in both areas, but with different values – more industrial areas in the urban centres and less in the rural region. Thus, the land use impact estimate would indicate Inconclusive.

Lastly, when the analysis has not identified any expected land use impact, the score indicates No impact. All land use impact estimates are accompanied by an explanatory text, together with the above values, in order to capture the necessary differences and details.

Due to the nature of the foresight study, the estimates also incorporate **additional analytical steps** that provide more depth to the analysis as well as more details on the likelihood of occurrence of the policy or trend. These additional steps focus on the following aspects:

- Dependence score – An estimate focusing on identifying a necessary change in the current context or circumstance to achieve the policy objective or realise the trend. For instance, utilisation of novel technology in a sector depends on a technological breakthrough or adaptation of existing technology.
- Uncertainty score – An estimate, focusing on the potential occurrence of unexpected events that can affect the achievement of the policy or on the realisation of the trend – wild cards. These are



unexpected and can have a positive or a negative effect on a certain policy or trend – they can accelerate the change or the course towards achievement or they can disrupt it and put it off course. The Covid-19 pandemic is the most recent example of a wild card event.

- Overall probability estimate – An overall estimate, that outlines a broader assessment of the current circumstances, the dependence and uncertainty for a policy or trend and a judgement on how likely it is for the policy or trend to occur. This estimate incorporates considerations of the current context as well as the estimates from the previous stages. For instance, the probability estimate may indicate that a certain policy is more likely to occur due to a recent vote in the European Parliament. The overall probability estimate also includes a weighted indicator score, based on the two-stage analysis, including senior judgement. The weighted score can vary between 0 and 1 whereas a higher score indicates a higher probability estimate. The indicator is formed based on different weights assigned in the primary and secondary analysis, placing higher weight on the secondary analysis that also includes the senior judgement.

Lastly, for each policy and trend, **further background information** is provided, together with additional sources, used to perform the analysis. This additional information includes overall outline of the policy or trend, key events, decisions, or data that indicate a possible course of action.

Sections 5.1. and 5.2. of the report outline the reasoning for the land use impact estimate. They include specific outline of sectoral impact and other factors that lead to the potential land use impact of each policy objective and trend element of each policy and trend. These short summaries highlight the key conclusions. The detailed information on the classification of policies and trends, detailed sectoral impact, detailed land use impact, dependence, uncertainty, overall probability estimate, and further background information can be found in Annex 2.

4.3 Land use taxonomy

The study utilises a standardised land use taxonomy across the different stages. The taxonomy was agreed between Spatial Foresight and BZK and is mostly based on the categories, defined by CBS Netherlands (Centraal Bureau voor de Statistiek). From the existing categories of land use, a selection was done in order to accommodate the limitations of the study and to focus the foresight assessment. As a result, the following land use categories were determined: *Transport (incl. waterways)*, *Built-up area-Residential*, *Built-up area-Industrial area and offices*, *Agriculture-Greenhouses*, *Agriculture-Other*, *Woodland and nature*. These land use categories have been incorporated in the analytical steps and are also used to create land use profiles of the selected case studies, using data from the CBS database (with latest dataset from 2015). For two of the case studies, additional data sets with land use have been generated, based on the Copernicus Urban Atlas database (latest dataset from 2018). To ensure consistency in the analysis, the Copernicus Urban Atlas land use taxonomy has been aligned with the land use categories from CBS. As a result, the land use profiles in two of the case studies are aligned with the CBS taxonomy but are based on Copernicus Urban Atlas data. Since the Copernicus Urban Atlas data and CBS taxonomies are not fully aligned, some differences exist between categories. Additionally, inland waterways have not been included in the total Transport category of the land use profiles to avoid distorting the proportions of land use. They are a separate category as there are



significant differences between case studies. Further details on the land use taxonomy can be found in Annex 3. The case study land use profiles can be found in Annex 4.

4.4 Selection of five case studies in the Netherlands

To facilitate a broader selection of cases, Spatial Foresight generated land use profiles of COROP (Coördinatiecommissie Regionaal Onderzoeksprogramma) regions within the Netherlands, based on the identified dataset from CBS (Centraal Bureau voor de Statistiek). The profiles were reviewed in parallel to identify outliers or diverse distributions of land use. In addition to the considerations on land use distribution, the cases were also reviewed from geographic and territorial perspective, incorporating their location within the Netherlands, as well as their overall profile, predominantly following urban vs. rural dichotomy. Further considerations included geographical specifics, such as proximity to the North Sea coast and the distinction between the Randstad metropolitan area and the rest of the country. In addition to the proposed focus on COROP regions, further data was generated from the Copernicus Urban Atlas for two of the cases. The addition was necessary to provide a closer look on key urban centres. As a result, the following case studies were selected:

- Delfzijl en omgeving (COROP region)
- Achterhoek (COROP region)
- Rijnmond (COROP sub-region) – Copernicus Urban Atlas dataset
- Zuidoost- Noord-Brabant (COROP region)
 - Additional dataset for Eindhoven urban core – Copernicus Urban Atlas dataset
- Zuid Limburg (COROP region)



5 Potential impact on land use of EU policies and global trends

Following the methodology, outlined in Section 4, the EU policies and global trends were analysed and estimates on the potential impact on land use were drawn. The foresight analysis identified three thematic clusters, outlined below.

The thematic clusters represent grouping of the effects of the policies and trends. They illustrate a broader view on the effects of the policies and trends, pertaining to three main transitions that can have overlapping and reinforcing effects. The first transition is the environmental one. It outlines the ambitions and challenges in addressing climate change, achieving less pollution, the transition to more sustainable energy production. The EGD (European Green Deal) and the policies aligned with it (P1 – European Green Deal, P2 – EU Circular Economy Strategy and Action plan, P3 – EU Biodiversity Strategy and part of P4 – CEF - Connecting Europe Facility) form a large part of this Environmental thematic cluster, together with the T1 trend on renewable energy. The second thematic cluster is Digital, and it outlines the continuing effects of the use of technology in different spheres, its role in economy, labour and lifestyle. This group of policies and trends is formed by the digital aspect of policy P4 (CEF), part of policy P5 (Europe fit for the Digital Age), trends T2 and parts of T3, pertaining to remote work and wider adoption of technologies. The third group refers to the effects of geostrategic industries, the European and global consequences of major international events and the consequences of major societal changes. This cluster is named Geopolitics and key industries and it is formed by parts of P5 (Europe fit for the Digital Age) on geopolitical aspects, parts of T3 (Digitalisation) on international market dynamics, trend T4 (Global geostrategic plans of others) on global changes and trend T5 on social inequalities. The clustering is important for the analysis as the study team has identified several interdependencies between those and has aligned its estimates for similar effects across policies and trends. A visual representation of the links can be found in section 5.3. of this report as well as in specific references in some of the respective analytical chapters.

Furthermore, one of the main conclusions from the analysis of the policies is that the European Green Deal is an outlier from the selection. The EGD is a very broad ‘umbrella policy’ that sets out the EU ambitions for emission reductions and climate neutrality. As a policy framework on the highest level in the EU, it outlines both specific policy objectives, pertaining to the above ambitions, and sets out the priorities for a number of derivative policies (on European and national level) that are aligned with the EGD. To a large extent, the EGD is a policy of policies, rather than a standalone focused one. Three other policies are connected to the EGD – the EU Circular Economy Action Plan and Strategy (P2), the EU Biodiversity Strategy (P3) and the Connecting Europe Facility (P4). Therefore, it is recommended that the analysis for each of those is understood in reference to the EGD.

This section of the report presents the main findings from the analysis of EU policies and global trends with their potential implications on land use. A summary table of all EU policies and global trends, with their respective land use impact estimates, together with their overall probability score, can be found in Annex 5.



5.1 EU policies

The analysed EU policies are presented according to the thematic clusters outlined above, starting with the European Green Deal and the policies aligned with it and finishing with Europe Fit for the Digital Age policy.

5.1.1 European Green Deal (P1)

The European Green Deal is a high-level policy of the EU, outlining its ambitions to achieve climate neutrality in the long term by 2050 along with significant greenhouse gas emission reduction. The policy operates through regulations, technical assistance and strategies while also requiring national implementation plans. In addition, the EGD also acts as a “policy of policies”, having multiple other European policies aligned with it or utilising them as instruments to achieve the overall objectives.

The European Green Deal encompasses 8 thematic fields:

- A zero-pollution ambition for a toxic-free environment
- Preserving and restoring ecosystems and biodiversity
- From "Farm-to-fork": a fair, healthy, and environmentally friendly food system
- Accelerating the shift to sustainable and smart mobility
- Supplying clean, affordable, and secure energy
- Mobilising industry for a clean and circular economy
- Building and renovating in an energy and resource efficient way

In order to achieve the objectives under each thematic field, the EGD introduces or aligns with a number of sub-policies. Some of those policies have also been reviewed as part of this study – namely the EU Circular economy strategy and action plan (P2), the EU Biodiversity strategy (P3) and some aspects of the Connecting Europe Facility (P4). The remainder of the European Green Deal has been summarised under five policy objectives whose impact is estimated as part of this analysis. Further details on the selection and formulation of the objectives of the European Green Deal can be found in Figure 1.

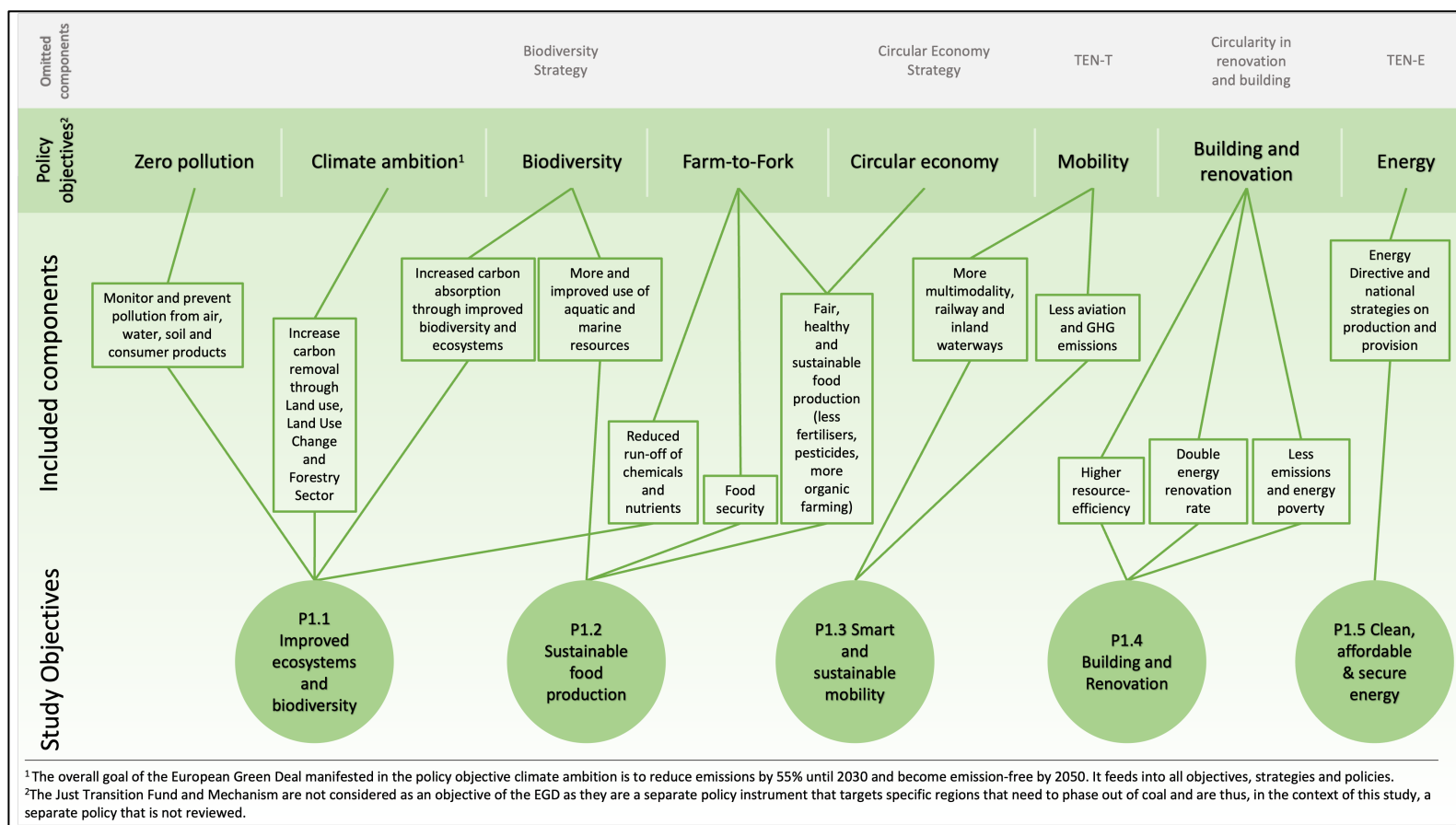


Figure 1. Outline of the structure of the European Green Deal and the formation of policy objectives for this analysis.



Objective 'Improve the condition of the environment' (P1.1.) outlines the broader ambition to decrease pollution of air, water, soil, and consumer products and to enhance biodiversity and ecosystems through specific measures, including reforestation and afforestation. This overall ambition is expected to contribute to the higher absorption of CO₂. The achievement of this objective will likely result in planning and policy measures to adapt production processes and economic activities to decrease pollution. For agricultural practices, this adaptation concerns the usage of less fertilizers and nutrient run-off.⁶ In addition, conservation measures aiming at improving the condition of natural areas with high biodiversity can be expected. Furthermore, targeted actions to expand forests for more carbon absorption and to offset air pollution can be expected. As a result of these actions, P1-European Green Deal could lead to expansion of natural areas or the establishment of new ones. It will also likely stipulate that the existing natural areas be preserved. The expected land use impact is expansive for *Woodland and nature* land use.

Objective 'More sustainable food production' (P1.2.) targets the adaptation of food systems to more sustainable practices. It aims at achieving a market transformation of the food sector by increasing the share of organic farming and lowering the utilization of pesticides. In addition, the objective outlines a higher ambition to improve the use of marine and aquatic resources for food provisioning. The achievement of this objective will require adaptation measures in agriculture and food production and will respectively affect agricultural areas. The sector will undergo a transition to achieve these new objectives, and this may create challenges initially.⁷ At a later stage, however, the transition will lead to more market opportunities for sustainable food and can thus lead to market growth. The increased food production capacity in the EU can decrease its dependence on food imports. As a result, it is likely that more agricultural land will be required to facilitate this. Therefore, the expected land use impact is expansive for *Agriculture-Greenhouses* and *Agriculture-Other* land use.

Objective 'Smart and sustainable mobility' (P1.3.) outlines the ambition of the EGD to transform the transportation sector. A specific emphasis is placed on the importance of multimodal transportation and railway. High speed railway is expected to triple by 2050. In addition, inland water transportation is also expected to increase. The prioritisation of these two modes of transportation should compensate the decline in air and coach transport. The latter two are expected to decline in order to achieve lower fuel demand and ultimately lower greenhouse gas emissions. The change in transportation from the perspective of the EGD will require the construction of new transport corridors through targeted investment as well as market adaptation to increase supply and demand to more sustainable mobility. As a result, it is expected that the coach and air transportation sectors experience decline while the water and railway transport experience growth. From land use perspective, the expansion of railway and waterways can lead to increased demand for land conversion to facilitate new transport infrastructure. These efforts can disproportionately affect different territories – key transport locations can become

⁶ When nitrogen and phosphorus, which are used as fertilisers in conventional agricultural practices, are washed off the fields through soil erosion caused by rain or irrigation, they can enter near-by water bodies. This nutrient-rich runoff causes water pollution and on the one hand, it can negatively impact aquatic ecosystems and biodiversity and on the other hand it can harm ground water quality. To mitigate or avoid these effects, proper nutrient management and the increase of spaces between fields and water bodies through e.g., buffer strips are crucial. These sustainable agricultural practices have an expansive impact on the land use type Agriculture. This can represent a significant challenge specifically in Dutch context due to the very intensive agricultural practices in the country.

⁷ These challenges can be particularly severe in areas with high share of agricultural land and developed intensive agricultural practices (such as De Achterhoek and Zuidoost-Noord-Brabant).



even more important and experience further pressure to expand their available infrastructure, while less connected regions can acquire new transport links. Still, it is expected that some regions will remain disconnected from the main transport grids. As a result of the achievement of this objective, it is expected that the *Transport (incl. waterways)* land will expand, thus the expected land use impact for this category is expansive. At the same time, the improved connectivity of suburban regions as a result of the new transport infrastructure can lead to more convenient options for commuting and thus increase demand for residential areas outside of central urban locations.

Objective 'Double energy renovation rate' (P1.4) targets the adaptation measures for the built environment to achieve better energy efficiency. The objective encompasses renovation measures for buildings and the market adaptation of the construction sector to more sustainable practices and resource efficiency. Additionally, the objective stipulates the need for renovation of buildings to achieve better energy savings as well as the adaptation of construction practices for new buildings to fulfil these criteria. These changes in construction requirements will also result in market adaptation that may present a challenge for some companies in the construction sector and the housing market. However, at a later stage it is expected that the new standards will open new opportunities for the construction industry and thus new opportunities for growth.

Objective 'Affordable clean energy' (P1.5.) outlines the ambition to provide clean and secure energy to citizens and industry. In addition to improving overall energy efficiency, the achievement of the objective will require investment in renewable energy projects of different scales – from large-scale renewable energy farms to small-scale household or community-based renewable solutions. Respectively, in non-built areas, the need to allocate space for larger scale projects may put pressure on agricultural land. In built areas, the allocation of space for smaller projects can potentially increase the land use demand in residential areas.

The European Green Deal envisions further expansion of railway and waterway transportation, therefore its anticipated effects on transport land use are expansive. From the perspective of the European Green Deal, further expansion of urban and built areas is discouraged to ensure the preservation and expansion of natural areas. At the same time, the further development of natural parks and protected areas can increase tourist flows to those areas as they become more attractive for recreational activities. This can also result in increased need to construct new residential areas close to parks and nature. The improved connectivity between regions

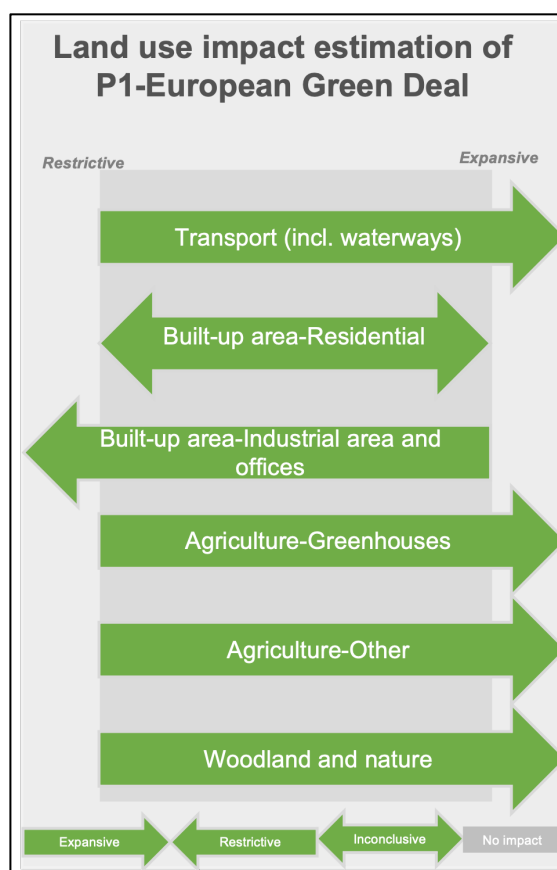


Figure 2 – Land use impact estimate of P1-European Green Deal



and cities can also fuel sprawl as people will have more options for mobility and commuting. This can take the pressure off densely populated areas by providing more opportunities for investment and livelihoods in underdeveloped regions (thus implying lower demand for *Built-up area-Industrial area and offices* and restrictive land use impact). Based on the different anticipated effects of these changes in different regions, the land use impact estimate for *Built-up area-Residential* is inconclusive as it is difficult to determine the proportion and weight of the changes in demand in the different types of territories. Figure 2 outlines the summarised potential effects of P1 – European Green Deal on land use. Further details for the policy can be found in Annex 2.

Interrelations with other policies and trends

The European Green Deal acts as a high-level policy of the EU and policies Circular Economy Strategy (P2) and Biodiversity strategy (P3) are aligned with it. Respectively, the effects of those policies can be seen as subordinate to the EGD objectives in the specific areas that they address – the transition to circular economy and the preservation of biodiversity. The effects are not cumulative between those policies – meaning that policies Circular Economy Strategy (P2) and Biodiversity strategy (P3) are contributing to the achievement of the objectives of the EGD, rather than having parallel overlapping objectives and effects. Policy CEF (P4) is also aligned with the EGD, however, it focuses on key projects in transport infrastructure, thus it also contributes to the overall objectives of the EGD, but it has a more specialised focus. Lastly, trend Renewable energy (T1) has a reinforcing effect with policy EGD (P1) – the overall increase of the usage of renewable energy as well as advancements in technology and their wider adoption will occur in parallel with achieving the EGD objectives, thus the trend and policy will have reinforcing effects.

5.1.2 EU Circular Economy Action Plan and Strategy (P2)

The EU Circular Economy Action Plan and Strategy are key policy instruments supporting the European Green Deal. Through the introduction of regulations and new product standards they aim for market transformation of different economic sectors. The transformation focuses on increased reuse of products, materials, waste, as well as a shift in supply chains and sourcing practices. These policy instruments will require the development of national, regional, and local strategies to introduce or increase circularity in markets. The anticipated change encompasses both changes in consumer behaviour, by targeting specific practices on local level, as well as overall market transformation with adapted and new production or processing industrial practices.

Objective ‘Sustainable products’ (P2.1.) aims at increasing the supply of sustainable products on European markets. Sustainable products are expected to have increased longevity, be subject to repair and be produced by recyclable materials. Objective ‘Empowering consumers’ (P2.2.) aims at changing consumer behaviour to achieve increased demand for such products and thus match the increased supply. The consumer behaviour change is expected to be achieved with measures for more information to consumers and improved transparency of product cycles. Objectives P2.1. and P2.2. are complementary and outline the envisioned market transformation from supply and demand side. As a result of the market transformation expected from the achievement of the above two objectives, it is expected that production processes will require a significant change. This transition is expected to be a



challenge for some enterprises and may result in their closure or phase out. At the same time, this market transition will also open new opportunities for businesses in the production of new circular and sustainable products. These new opportunities may lead to increased demand for new industrial zones or the adaptation of existing ones, implying expansion. As a result, it is expected that the market transition to circular economy can have expansive⁸ effects on *Built-up area-Industrial area and offices* land use.

Objective 'Circular value chains' (P2.3.) also addresses the above market transformation, emphasising the adaptation of value chains. The expected change focuses especially on electronics production, batteries and vehicles, plastics, textiles, food, water, and nutrients. The circular value chains are expected to increase the reuse of resources in industry – between businesses within one value chain and between different value chains. To achieve this, industry and businesses may rethink their sourcing practices, shifting their focus on supplying materials from local business networks or reusing waste products from traditional linear production cycles. This can result in a shift from long distance to short distance transportation with the possible effect of lower transportation costs. Depending on the industry and the existing value chains, this transformation may take different shapes in different territories. For established industrial or production locations this can open new opportunities for expansion and growth of facilities. For lagging regions, the adapted business processes may also provide a chance to improve competitiveness by establishing new production and industry sites. As a result, it is expected that there will be more demand for *Built-up area-Industrial area and offices* land use which can take different forms in different territories. This may involve new planning practices for the construction of smaller and more compact industrial areas, improving proximity of supply chains. These new sourcing practices can also decrease dependence on imports from outside of the EU. As a follow up effect of this adaptation, this can also lead

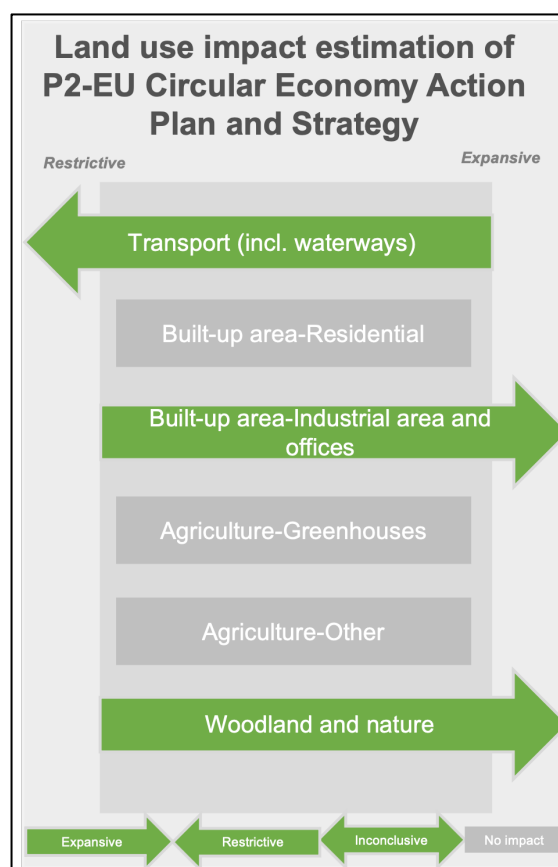


Figure 3 - Land use impact estimate of P2-EU Circular Economy Action Plan and Strategy

⁸ The philosophy and objective of the policy and the circular economy transition is to support the adaptation of production processes and value chains to more circular practices while in parallel to also support the nearshoring and re-shoring of supply chains back to Europe in order to decrease distances and enable shorter value chains. With that said, our assessment is that during a period of adaptation to this transition, closure of facilities and transition of production sites is more likely to occur as part of the re-shoring outlined above outside of strongly competitive areas, leaders in the transition, such as the EU. Therefore, this would result in growth of the circular economy industry within the EU, hence it is more likely for new facilities to be created and industrial zones to be expanded as the EU re-absorbs economic activity from abroad. Furthermore, the objective to establish shorter value chains may also result in creating new industrial zones that support better proximity between different industries, suppliers, and facilities.



to restrictive effects on *Transport (incl. waterways)* land use as sourcing practices will shift to closer locations.

Objective 'Reduce waste' (P2.4.) focuses on the transformation of waste processing in order to reduce total waste generation and halve the amount of non-recyclable waste. The measures for this objective will complement the previous objective. Through the adaptation of waste management practices, it is expected that the environment will be less polluted, and less space will be used to dispose of non-recyclable waste.

Objective 'Circularity accessible' (P2.5.) is broader, outlining the ambition to promote circular practices for citizens and authorities on different levels. The objective encompasses various soft measures, such as local action plans and campaigns, to educate and support the desired behavioural change and achieve a more sustainable lifestyle.

As a result of the outlined effects of policy Circular Economy Strategy and Action Plan (P2), it is expected that there will be an increased demand for industrial areas to facilitate the circular transition as new industrial facilities will need to be built to accommodate the adapted circular production processes. New industrial areas may be required also for new businesses that use the circular economy transition as an opportunity to introduce new products on the market. Therefore, the anticipated land use impact is expansive for *Built-up area-Industrial area and offices*. The optimisation of supply chains, especially in terms of local sourcing and proximity, is expected to decrease the demand for transportation, including imports, and thus result in restrictive effects on *Transport (incl. waterways)* land use as businesses will require shorter distances to source their products. Since the circular transition can contribute to overall improvement of the environment, less pollution, and more stable ecosystems, it is expected that in the longer-term natural areas will expand – thus expansive effects on *Woodland and nature*. Figure 3 outlines the summarised potential effects of P2 – Circular Economy Strategy and Action Plan on land use. Further details for the policy can be found in Annex 2.

Interrelations with other policies and trends

The policy is aligned with the European Green Deal (P1). Partial reinforcement can be expected between objective 'Circular value chains (P2.3.) and trend element T4.2. on the dependence of the EU on critical material imports from Africa. Achieving circularity in value chains can decrease this dependence, thus the EU can be less affected by the influence of trend element 'China and Russia influence' (T4.2.) in Africa (and other regions) by sourcing more of its materials internally through circular practices.



5.1.3 EU Biodiversity Strategy (P3)

The EU Biodiversity Strategy is another key policy supporting the European Green Deal. The policy focuses on measures for environmental protection, specifically targeting positive effects on biodiversity in different territories. It is expected to be implemented through targeted action plans and dedicated financing as part of the multi-annual financial framework of the EU.

Two of the policy objectives focus directly on land use. Objective 'Protect nature' (P3.1.) envisions the expansion of protected areas on land and sea. Objective 'Restore nature' (P3.2.) envisions specific measures on restoring natural areas. The achievement of those objectives is expected to widen the network of protected areas, including restoring freshwater ecosystems, such as wetlands and coastal areas, as well as riverbeds and marine areas. The main results of these interventions will lead to better protection of the environment, reduced pollution, better protection of wildlife and better climate resilience. From an economic perspective, the achievement of those objectives can result in new business opportunities, including nature-based tourism. The overall environmental improvement will

likely contribute to improved soil quality, less pollution from agriculture and improved quality of life for citizens. The measures under these two policy objectives focus both on natural areas and agricultural ones, specifically outlining the need for their expansion. Respectively, the policy envisions restrictions on the built environment⁹ in order to avoid further conversion of natural land.

Objectives 'Enable transformative change' (P3.3.) and 'EU for an ambitious global agenda' (P3.3.) encompass the specific policy measures to deliver the desired effects of the previous two objectives within the EU and beyond. They outline the required policy actions on national level within member states as well as EU's global ambition to support the preservation of biodiversity.

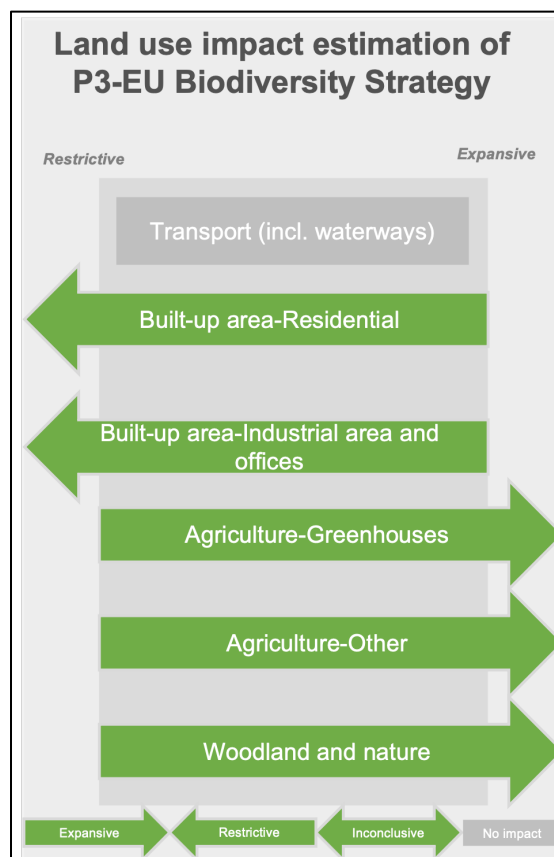


Figure 4 -Land use impact estimate of P3 – EU Biodiversity strategy

⁹ From the perspective of the Biodiversity strategy it is very clear that urban sprawl and expansion of the built environment should be restricted while simultaneously expanding the natural and agricultural areas: "To put biodiversity on the path to recovery by 2030, we need to step up the protection and restoration of nature. This should be done by improving and widening our network of protected areas and by developing an ambitious EU Nature Restoration Plan.(...)This means reducing pressures on habitats and species, and ensuring all use of ecosystems is sustainable. It also means supporting the recovery of nature, limiting soil sealing and urban sprawl, and tackling pollution and invasive alien species." The strategy highlights the importance of greening in cities and plans the development of Urban Greening Plans that would support the overall biodiversity objectives. These measures are envisioned in parallel to restricting the expansion of built areas. Therefore, the Biodiversity strategy, in-line with the EGD, effectively supports densification of cities, rather than their expansion.



Policy EU Biodiversity Strategy (P3) clearly stipulates direct land use effects by expanding agricultural and natural areas and restricting the expansion of the built environment¹⁰. The objectives of the policy envision the expansion of agricultural and natural areas and the preservation of already existing areas. As a result, the potential land use impact of the policy is expansive for *Agriculture-Greenhouses*, *Agriculture-Other* and *Woodland and nature* land uses. The policy discourages the expansion of the built environment to preserve natural areas. As a result, the land use impact on *Built-up area-Residential* and *Built-up area-Industrial area and offices* is, respectively, restrictive. Figure 4 outlines the summarised potential effects of P3 – EU Biodiversity strategy on land use. Further details for the policy can be found in Annex 2.

Interrelations with other policies and trends

The policy is a sub-policy to European Green Deal (P1) and is aligned to it, targeting specifically the necessary land use measures to facilitate the protection of biodiversity.

5.1.4 Connecting Europe Facility (P4)

The Connecting Europe Facility is a main policy and financial instrument of the EU, focusing on transport, energy, and digital infrastructure. Its largest component is transport infrastructure. Its priorities in transport and energy infrastructure are aligned with the European Green Deal and they contribute to the overall objectives of the EU to achieve carbon neutrality. The policy operates through financial instruments and targeted investments in key infrastructural projects. The specific investment projects are outlined in different territorial networks such as TEN-T (Trans-European Transport Network) and TEN-E (Trans-European Networks of Energy).

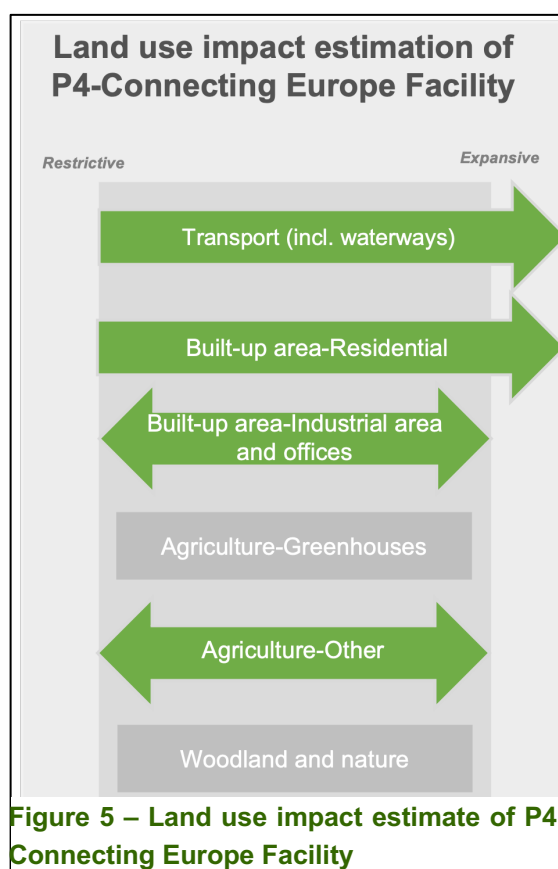
Objective 'TEN-T' (P4.1.) outlines the ambition to complete all projects within the core and comprehensive transport networks of the EU. The networks also include the pan-European transport corridors which encompass parts of the transport infrastructure. The investments under this objective of the programme target concrete transportation projects, predominantly in railway transport. Railway transport is outlined as a main investment priority and the larger part of the budget is allocated to it. This prioritisation is aligned with the ambition of the EU to expand sustainable mobility. The rest of the investment focuses on water transportation and road infrastructure, among others. As direct result of these investments, it is expected that more land will need to be allocated for transport as new transport infrastructure will need to be built and some of the already existing ones may need to be expanded. The core and comprehensive networks encompass different regions. The concentration of CEF projects and parts of the pan-European corridors is often higher within and between established major cities,

¹⁰ As a part of the EU Biodiversity Strategy for 2030, the EU Nature Restoration Law will enhance restoration and protection of nature. The European Parliament adopted the Nature Restoration Law on 12 July 2023. Adoption of Nature Restoration Law increases the probability of the envisioned effects of the EU Biodiversity strategy. The proposal for the Nature Restoration Law aims to restore ecosystems, habitats and species across the EU's land and sea areas in order to enable the long-term and sustained recovery of biodiverse and resilient nature, contribute to achieving the EU's climate mitigation and climate adaptation objectives and meet international commitment. Further information: https://environment.ec.europa.eu/topics/nature-and-biodiversity/nature-restoration-law_en#policy-areas; <https://www.europarl.europa.eu/news/en/press-room/20230707IPR02433/nature-restoration-law-meps-adopt-position-for-negotiations-with-council>.



agglomerations, and metropolitan areas, especially in the core network of TEN-T. The comprehensive network acts as a secondary network linking less connected regions to the core network. Still, the two networks exclude certain regions, therefore the effects of the achievement of this objective are expected to be disproportionate, depending on the specific location and its inclusion in the TEN-T networks. As a result of the expansion of transport infrastructure, it is expected that the policy will have expansive effects on *Transport (incl. waterways)* land use. The different levels of connectivity to transport networks can have varying effects on the economic performance of different regions. More connected places can benefit from the improved connectivity, while places which are not well-connected may experience economic decline. The improved connectivity within and between cities and regions can have follow up effects on the economy and social behaviour, such as people's tendency to commute to work or their transport preferences. The improved transport links can contribute to better competitiveness and increased investment activity, especially in more connected places. As a result, it can be expected that those places can experience economic growth. As a result of that, more land use may need to be allocated for industry and business activity (thus expansive effects on *Built-up area-Industrial area and offices*). The improved economic prospects of the connected places can negatively impact the places which are not connected to the network. Respectively, the economic activity there can decline, and less space may be necessary for that (thus restrictive effects on *Built-up area-Industrial area and offices*). Better economic prospects in the connected territories and decline in less connected ones can influence the attractiveness of places and subsequently people and enterprises may choose to move to places with more opportunities. As a result, larger, better-connected cities may experience population growth, while less developed and less connected regions can lose population. From land use perspective, this could lead to increased demand for residential space in larger cities and lower demand in left-behind places.

Objective 'TEN-E' (P4.2.) outlines the ambition to improve the energy infrastructure connectivity. The objective focuses specifically on removing bottlenecks in existing networks by financing projects pertaining to network compatibility. The objective also envisions investment in digitalising energy networks and their optimisation in order to achieve a more integrated European energy market. The more integrated energy market can support the energy transition to more sustainable practices and contribute to improved energy security. Specific attention is paid to cross-border energy infrastructure, including small-scale projects for local energy production. The achievement of this objective implies that more space will need to be allocated for energy infrastructure. Usually this requires land conversion of agricultural land, closer to settlements. However, it





is difficult to estimate how significant this impact can be. Therefore, the anticipated land use effects are inconclusive for *Agriculture-Other* land use.

Objective 'TEN-Telecom' (P4.3.) focuses on improving digital connectivity through targeted investments in digital infrastructure and broadband. The improved digital connectivity depends on access to broadband; therefore, this objective aims to ensure that infrastructure and connectivity are available for all European citizens in the different regions of the EU. These investments support the digital transition of the EU and are expected to improve the digital market. The effects of the improved Internet connectivity are wide, and they can contribute to changing social and market behaviour. Better connectivity can increase the chances of larger social groups to work online without having to commute to their workplaces, depending on the sector. Online communications can also support remote forms of education and health. From a business perspective, improved connectivity can contribute to more efficient operations and access to markets. As a secondary effect of this objective, it is expected that people may spend more time at home if they are able to perform their main activities remotely. As a result, this can lead to increased demand for residential space (see also trend T3 – Accelerated digitalisation).

The achievement of the objectives of this policy directly stipulates increased land allocation for transport infrastructure, therefore expansive effects for *Transport (incl. waterways)* land use, depending on the location and its connection to the TEN-T network. The improved connectivity between places and the improved digital connectivity will more likely lead to better economic prospects for well-connected and developed places at the expense of less connected and developed ones. Therefore, the effects on *Built-up area-Industrial area and offices* land use are inconclusive. The combined expected effects of better physical connectivity improved digital connectivity and the increased demand for space for renewable energy are expected to result in the further expansion of the built environment, especially in larger and better-connected cities. As a consequence of the improved economic prospects and the improved digital connectivity there can be more demand for residential space, especially in better connected places, therefore overall expansive effects on *Built-up area-Residential*. The extent of the effects on agricultural land from new energy projects is difficult to estimate, therefore the impacts on *Agriculture-Other* land use are inconclusive. Figure 5 outlines the summarised potential effects of P4 – Connecting Europe Facility on land use. Further details for the policy can be found in Annex 2.

Interrelations with other policies and trends

Objectives 'TEN-T' (P4.1.) and 'TEN-E' (P4.2.) are contributing to the overall goals of the European Green Deal (Policy P1) with the increased share of less polluting transport and more integrated energy markets. The decrease of emissions from transport and the improved energy connectivity contribute to the objectives of achieving less environmental pollution and improved energy efficiency. The increased share of renewable energy, however, can trigger 'rebound effect' where people feel more comfortable using more energy, knowing that it has been generated sustainably. Objective 'TEN-Telecom' (P4.3.) has a strong influence on a number of other policies and trends. As a major investment instrument in digital infrastructure, it is a backbone to policy Europe Fit for the Digital Age (P5) as Internet connectivity and digitalisation are prerequisites to achieve the objectives of P5. From the same perspective, it acts as an enabling factor to trend Working from anywhere (T2) as the main premise of the possibility to work



from elsewhere is Internet connectivity. In the same vein, it acts as an enabler for trend Accelerated digitalisation (T3). It has also indirect implications to trend Tyranny of merit (T5) as it relates to the digital divide – places or people not connected to the network are at a disadvantaged position in reference to any potential advancements in digitalisation.

5.1.5 Europe Fit for the Digital Age (P5)

The Europe fit for the Digital age policy is the second high level policy of the EU (in addition to the EGD), focusing on the digital transition. The policy is expected to support the adaptation of markets, social practices, and competitiveness in the EU in the technological sphere. The policy is cross-cutting and has influence on different economic sectors, beyond the strict focus on the technology industry. For some of the objectives, specific targets were set, most notably pertaining to the ambitions of the EU to become a global leader or improve its global market positioning (e.g., semiconductors). This objective has been included as it concerns key sectors and their expansion which has a higher likelihood to impact land use. Additionally, the objective on semiconductors has a geopolitical aspect in reference to the desired increased cooperation and trade with the USA, therefore this specific objective has also been included. The objectives pertaining to safe and accountable online environment and fair and open digital markets (Digital services act and Digital markets act) have been excluded as they are supportive of the management of the digital markets. The expansion of the digital market is also covered under the Accelerated digitalisation trend (T3) together with digital public services (pertaining to European Digital Identity stream in this policy). AI (artificial intelligence) is a cross-cutting topic across a few objectives under this policy – the objectives with higher economic relevance have been chosen (EU as an AI global hub, AI in agriculture). AI is only one of many digital aspects in healthcare, therefore this objective has been excluded as digitalisation in health is also covered under trend Accelerated digitalisation (T3). The security dimension of the policy has been included as part of the objective on EU's open strategic autonomy, grouped with the objective on securing the supply of critical raw materials in cooperation with the US. Cybersecurity elements (related to digital advancements in European Defense) have been also considered under the objective of critical computing capacity expansion. Space dimension of the policy has been excluded as it pertains to investments in space resources, satellites, and traffic.

Objective 'EU semiconductor leader' (P5.1.) outlines the ambition of the EU to become a key global player in the semiconductor industry with a specific target of reaching 20% of global market share. The semiconductor industry is a critical element of the increasingly digitalised world as it is responsible for the production of the main devices and circuits utilised in widespread technology such as laptops and smartphones. This industry has global significance due to the high dependence on these technologies in the increasingly digitalising world. The ambition of this objective is to further expand existing production facilities of semiconductors as well as to establish new ones. The objective is also viewed in reference to the global production value chains and stipulates an increased cooperation with the US in this regard. It is expected that the achievement of this objective, through public investments and supporting policy instruments, will achieve economic growth and expansion of the technological sector. This growth will depend also on market uptake and investment decisions. Established competitive locations in this industry can take advantage of these favourable conditions and further expand their production facilities, implying increased demand for industrial space. The increased share of this industry in the market can also open opportunities for new investment in less-established locations,



however, this will depend on the accessibility to transport infrastructure and the availability of qualified staff. It is expected that the growth of the semiconductor industry will also result in more job opportunities that will drive increased migration to cities and regions with strong positions on the market and thus increase the demand for residential space there. The migration patterns as a result of this change can include internal migration within countries – more likely from less developed regions to more developed ones; external migration from countries within the EU and beyond. Additional effects to economic growth and improved competitiveness can come from the expected increased investment by the US in this industry and in others such as the supply of critical materials. The expected growth of this industry indicates potential expansion of industrial and office areas (*Built-up area-Industrial areas and offices*).

Objective 'EU critical computing capacity' (P5.2.) stipulates the ambition of the EU to advance its technological leadership through the construction of new servers and critical infrastructure for the digital transition. The objective is also supported by increased investment in research and development. The objective is expected to support the critical computing field through public investment and through enabling market uptake. The establishment of more critical computing capacity locations also has a geostrategic impact as it contributes to improved cybersecurity and better supervision of the digital sphere. The objective specifically outlines the need to build new critical computing centres. As this infrastructure is of strategic importance, it has to be built in areas less susceptible to natural disasters and with more stable climate. This excludes coastal areas with higher risk of floods or rising sea levels, but inland locations can be more suitable. As a highly specialised infrastructure, servers and computing locations will also require qualified personnel to operate, therefore places with more established traditions in the IT (information technology) industry may be better positioned to host this new infrastructure. The construction of those facilities can expand industrial and office areas (*Built-up area-Industrial areas and offices*).

Objective 'AI in agriculture' (P5.3.) outlines the ambition of the EU to advance the use of artificial intelligence in agriculture. The different solutions in this field include the accumulation of big data sets and their subsequent analysis to optimise crop production and cycles. Furthermore, technological innovation in collection and processing can also achieve efficiency. As a result, agriculture can become less polluting and contribute to improved biodiversity in agricultural areas. The objective envisions a market transformation of the agricultural sector through partnership between public and private players. Respectively, the achievement of this objective will depend on the capacity of the agricultural industry to adopt the new technologies. As the main anticipated impact is improved efficiency, it can be expected that the same agricultural land should yield more, implying that no expansion of agricultural areas will be necessary. Therefore, the expected land use impact is restrictive for *Agriculture-Other*.

Objective 'EU AI hub' (P5.4.) outlines the ambition of the EU to become a global location for advanced AI technologies through better collaboration between business, industry, and science. The objective also envisions better cooperation between private and public players in the AI sector. The achievement of this objective can result in growth of the AI sector and more public and private investment there. In addition, new or expanded cooperation between universities, research centres and industry can be expected. This can contribute to the growth of the technology industry and lead to more demand for industrial and office areas (*Built-up area-Industrial areas and offices*).



'EU strategic autonomy and the US' (P5.5.) outlines the geopolitical aspect of the policy. It stipulates the ambition to strengthen EU's open strategic autonomy by decreasing its dependence on imports. It places a specific emphasis on improved cooperation with the US in the area of critical materials supply, including for semiconductors, and imports. Additionally, it also envisions alignment with the US in global trade and economic strategic decisions. The effects of the achievement of this objective will likely contribute to the improved competitiveness in key technological sectors, such as semiconductor production and technology. Respectively, it should contribute to growth in these sectors and increased market activity and more job opportunities, especially in established competitive locations. Respectively, more demand for industrial and office areas can be expected in those areas as well as increased demand for residential space as a result of the increased attractiveness of those cities (*Built-up area-Industrial areas and offices* and *Built-up area-Residential*).

As a result of the achievement of the objectives of this policy, it is expected that further economic growth will occur in the semiconductor and technology industries, including through the direct expansion of production facilities and the construction of new ones. Respectively, this can have follow-up effects on the whole technological ecosystem and further investment in this field can be expected. The economic growth will favour already established cities and regions with existing ecosystems and qualified staff. They will continue to attract investment and migration. As a result, the land use impact estimate would be expansive for *Built-up area-Industrial area and offices* and *Built-up area-Residential*. The use of AI in agriculture can lead to optimisation of cycles and respectively more yields from the same or less agricultural land. Respectively, the land use impact on *Agriculture-Other* is restrictive. Lastly, the construction of new critical computing capacity will need to occur in inland areas with specific geographical characteristics to ensure the physical security of these strategic locations. This could lead to conversion of natural areas in inland territories, thus restrictive effects on *Woodland and nature* land use. Figure 6 outlines the summarised potential effects of P5 – Europe Fit for the Digital Age on land use. Further details for the policy can be found in Annex 2.

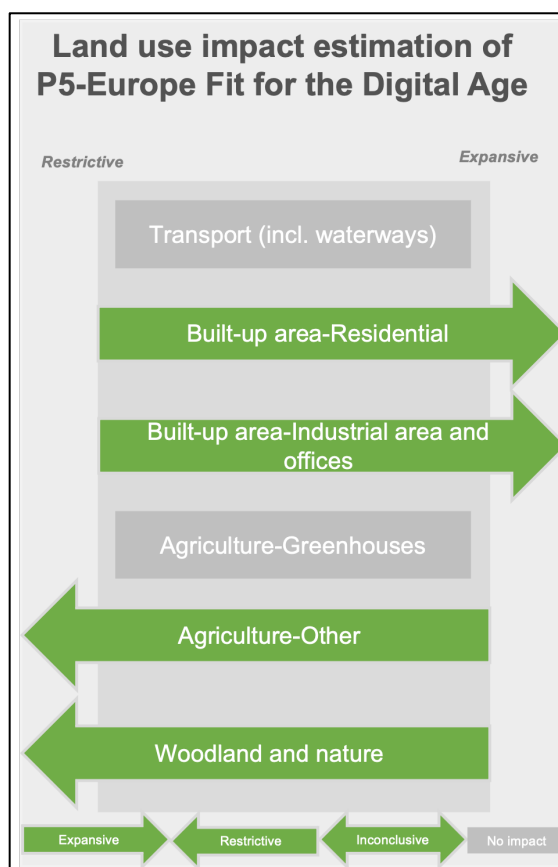


Figure 6 – Land use impact estimate of P5-Europe Fit for the Digital Age

Interrelations with other policies and trends

As a strategic high-level policy of the EU, policy Europe Fit for the Digital Age (P5) has a wider scope. However, the objectives included in the analysis are specific and they have clear relations to other



policies and trends. Policy P5 is related to policy objective 'TEN-Telecom' (P4.3.) on the expansion of the digital infrastructure in the EU. In this context, the policy can also increase the risk of digital divide as its strong focus on digital industries and activities can exclude places which are not competitive in these industries or are not well-connected. Consequently, this can contribute to inequalities and feed into trend 'Tyranny of merit' (T5). Objectives 'EU semiconductor leader' (P5.1.) and 'EU strategic autonomy and the US' (P5.5.) have a strong geopolitical component as they emphasise on the role of the EU in the global economy and its cooperation with the USA. Respectively, this objective can be influenced positively – reinforced – by trend element 'QUAD (Quadrilateral Security Dialogue) cooperation' (T4.5.) which explores the possibility of further expanding the competitive advantage of the developed world in the West with closer cooperation of the QUAD region (Indo-Pacific). In another hypothesis, however, a change in geopolitical aspirations and decisions can negatively impact the achievement of objective 'EU semiconductor leader' (P5.1.), the EU can lose its competitive advantage if the US shifts its priorities. This opposite hypothesis is developed in trend element 'US and China tech supremacy' (T4.1.). Policy P5 has an overall enabling effect on trend Accelerated digitalisation (T3) as it encompasses one aspect of the potential increased digitalisation globally.

5.2 Global trends

The analysed global trends start with the environmental trend and continue with the trends that are related to technology. The analysis concludes with the global geostrategic trend and the social trend.

5.2.1 Increasing shift to renewable energy (T1)

The increasing shift to renewables trend encompasses the transition of energy production from fossil fuels to renewable sources, such as solar and wind. The trend is expected to have effects on policy priorities, energy markets and consumer behaviour. It should result in increased share of renewable energy for industrial and household consumption and to shift priorities in energy policy. The trend will contribute to climate change adaptation and less pollution of the environment.

Trend element 'Need for renewable energy' (T1.1.) encompasses the shift of priorities in energy production from fossil fuels to renewables. Increased considerations for energy security, especially considering geopolitical shifts, will prompt governments to place a stronger emphasis on renewables. Furthermore, the climate adaptation and the phase out of fossil fuel dependence will further increase the demand for renewables.

Trend element 'Policy for renewables' (T1.2) outlines the efforts of public authorities to facilitate this transition. It is expected that more public funding will be allocated to constructing renewable energy facilities, including energy storage, transmission, and distribution. Furthermore, policy instruments can be introduced to support this transition on different scales. These can be market incentives for industry and financial support for households and energy communities. These efforts will result in wider adoption of renewable solutions at different scales. As a result, it is expected that more land will be required for the construction of renewable energy farms. Larger scale projects may require land conversion or dual use (e.g., agrivoltaics), usually from agricultural and natural areas, implying restrictive effects on this



type of land use. In addition, smaller scale projects in the built environment may increase the demand for space in residential and industrial areas.

Trend elements 'Research on renewables' (T1.3.) and 'Awareness of renewables (T1.4.)' will have a supportive role to the market transition to renewable energy sources. The increased investment in research and development can contribute to the introduction of new technologies for renewable energy, thus increasing investment activity and market share of these industries. More collaborations between universities, research centres and business can be expected. In parallel, raising public awareness and adapting energy consumption patterns of citizens is expected to achieve consumer behaviour change. This change will result in more demand for renewable energy solutions, thereby matching the expected increased supply of those on the market.

Trend element 'Investment and jobs in renewables' (T1.5.) focuses on the market growth of renewable energy. It outlines that renewable energy will have an increased share in the economy as an investment priority for private capital and, consequently, as labour opportunities. This shift will result in increased demand for skilled workers and more employment in renewable energy production. This increase demand can also have effects on migration patterns as more people may consider working in this field.

As a result of the effects of the trend elements, it is expected that more land will be required for the construction of renewable energy sources. Larger scale projects will likely require land conversion or dual land use (e.g., agriculture and renewable energy) outside of densely populated areas, while smaller scale projects in the built environment may increase the need for residential space. While the rooftops of some new buildings can be utilised for solar energy, other solutions, such as small-scale wind energy generators may require the expansion of residential lots in residential areas with less density. Already completed buildings can adopt rooftop solar solutions also, again depending on the construction characteristics. The increased economic activity in the sector can also trigger increased demand for industrial areas. Respectively, the land use impact of this trend is expected to result in expansive effects on *Built-up area-Industrial area and offices* and *Built-up area-Residential*. Renewable energy infrastructure is categorised as industrial space. The further expansive effects come from the usage of already built environment (residential and industrial) to accommodate space for renewable solutions. Restrictive effects are expected for *Agriculture-Other* and *Woodland and nature*. Figure 7 outlines the

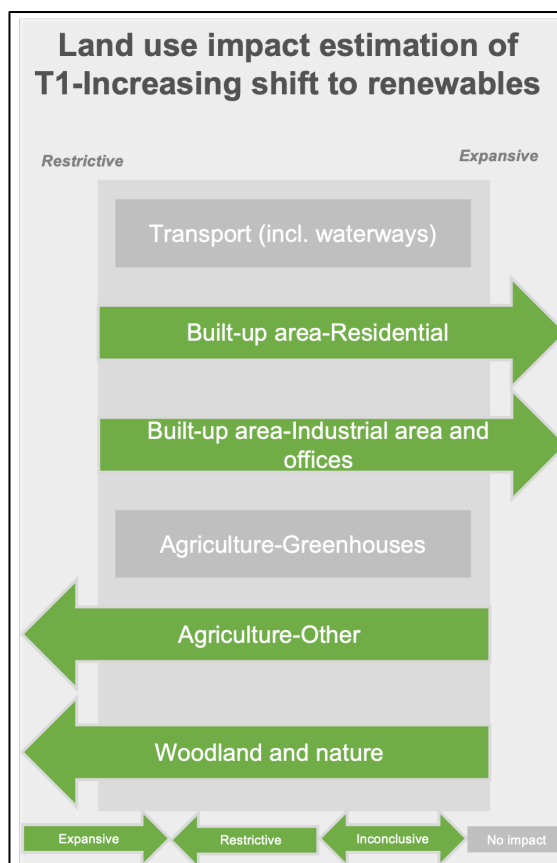


Figure 7-Land use impact estimate of T1-Increasing shift to renewables



summarised potential effects of T1 – Increasing shift to renewables on land use. Further details for the trend can be found in Annex 2.

Interrelations with other trends and policies

Trend T1 has reinforcing effects to the cluster of policy objectives aligned with the European Green Deal (P1 – EGD, P2 – Circular Economy Strategy, P3 – Biodiversity strategy, parts of P4 – CEF) as the transition to renewable energy is a vital component of the green transition and climate change efforts. In addition, the trend element 'Investment in jobs and renewables' (T1.5.) has indirect link to trend element 'QUAD cooperation' (T4.5.) due to the growing need for skilled workers, which may influence migration patterns to the EU.

5.2.2 Working from anywhere (T2)

The Working from anywhere trend encompasses the transition in labour to remote and teleworking. The Covid-19 pandemic has illustrated how this adaptation can occur under force majeure circumstances. The ubiquity of technology in business and everyday life contributes to the possibilities in this regard. The trend involves the expected market transformation in certain industries to more flexible and digital work arrangements. As a result of this change, it also encompasses the expected social behaviour change of workers, adopting the new ways of working and minimising traditional divisions between working in one location and living in another. In EU context, the cross-border hybrid remote working is a specific case, observed in multiple regions – people living in a border region and working remotely across the border. This phenomenon is more common in cross-border functional areas. The trend also encompasses the necessary regulatory mechanisms for these new forms of working as well as the impacts on social cohesion.

Trend element 'Flexible work arrangements' (T2.1.) focuses on the business transformation of existing enterprises and the adoption of more flexible and hybrid (remote) working solutions. It is expected that this transformation in business practices will lead to optimisation of work processes and business practices. Shifting production to remote working can decrease the demand for office space and optimise business expenses as space and resources for fewer people will be required in office locations. This is likely to be observed in cities with stronger economic position in office-based services. This transition, however, will depend on the economic sectors involved. Most of the industry enterprises will not be able to shift to flexible work arrangements due to the nature of their business. For instance, enterprises in manufacturing and construction or in providing physical services (e.g., car repairs, home repairs, restaurants) will likely remain in their usual working arrangement with physical presence and without shifting to remote working. Respectively, this transition is more likely to occur in industries that do not require the manufacturing of physical products or service industries that can only operate in physical presence.

Trend element 'Cross-border remote working' (T2.2.) encompasses the specific scenario of remote working in cross-border areas – a phenomenon already observed in the EU. In some functional areas in cross-border regions economic activity, labour market and flows of people and goods are very advanced. As a result, the possibility of living in one country and working in another nearby increases.



As a result, people may have more options to choose where to live and where to work, especially in a well-connected and functional cross-border area. These options can allow them to select more affordable residential location or a location with better quality of life as opposed to strictly choosing to live where they work. As a result of the adaptation of working arrangements and the possibility of remote working, people can decide to have a job in one country while living in a town or a country with better quality of life, more affordable housing, or less-stressful environment. As observed during the pandemic, many people chose to move to suburban and rural areas while retaining their, now remote, jobs in the bigger cities. The specific format of cross-border remote working can involve again only industries whose operations allow for such arrangements, for instance research services, software development and back-office services. Still, the increased adoption of such practices can lead to changed recruitment policies where people from different countries can be hired remotely in another, thereby completely shifting the balance between work, and living locations and eliminating the need for commuting. The increased adoption of such practices can reduce demand for office space as living and working locations would not necessarily be paired together.

Trend element 'Digital nomadism' (T2.3.) includes the specific phenomenon of digital nomads and freelance specialists that work entirely online and do not necessarily need to work at a fixed location. This transition again relates only to industries which do not require physical presence to deliver their output. Technology and creative industries can accommodate such practices to some extent. As a result of increased demand for specialists in these fields, people may be given the chance to explore digital nomad lifestyles and working, thus again decreasing the need for office space in many locations but increasing the attractiveness of living locations with high quality of life and therefore the demand for residential space in those. The attractiveness of those destinations can also depend on seasonal peaks, depending on climate and the nature of the business in which they operate.¹¹

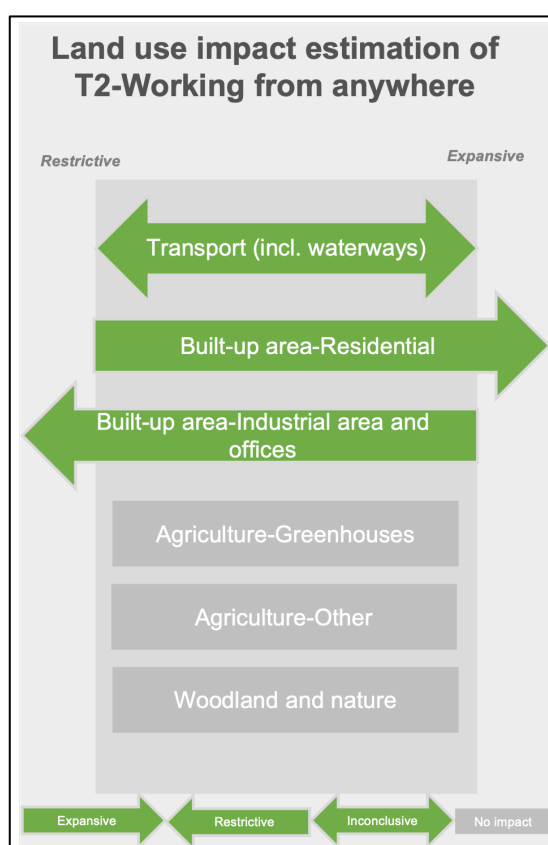
Trend element 'New work regulations' (T2.4.) includes the regulatory efforts that will come in place to facilitate the above transition. As current labour laws and social security systems are adapted to the traditional fixed location working, new regulations will need to be introduced to establish worker rights and business requirements as well as tax and social security arrangements. These new regulations can have indirect effects on the adaptation of business operations or on the choice of workers to select one location instead of another (e.g., to save taxes for example). At present, no EU-wide adjustments of tax and social security regimes to facilitate cross-border home office arrangements and digital nomadism are to be expected. On the contrary, in some countries and regions there are discussions concerning additional taxes for digital nomads.

Trend element 'Social division' (T2.5.) outlines the social effects of the transition to these new forms of working. As outlined above, many industries cannot adapt to remote working practices. This can lead to social division. People who can take advantage of the new forms of working (e.g., specialists in industries that can adapt to the new forms of working, such as software specialists, researchers, usually highly qualified workers) will be in a more privileged position as opposed to workers who need to be present at their workplace (e.g., workers in construction industry, in support services). Industries such

¹¹ <https://www.forbes.com/sites/oliverwilliams1/2021/10/18/exclusive-where-have-all-the-digital-nomads-gone/?sh=2cb48aaa2f0c>



as manufacturing, food production, trade and commerce, and hospitality will most likely not experience such a major transition as compared to technology and creative industries. As a result, divisions between social groups of workers in the different industries can occur where people without access to the Internet would not be able to take full advantage of the opportunities, while others will not have the chance to change their working and living habits due to the industry, they are employed in. Furthermore, the possibility of remote workers and digital nomads to choose the location that they live in can increase pressure on popular destinations and lead to increased demand for residential space and services. At the same time local and regional authorities in these places may not be able to catch up to the demand due to the lower tax collection as a result of remote working (especially if cross-border). This can lead to further division of territories where less developed regions would not be able to meet the demand and improve liveability. At the same time, areas which are not so attractive and have a lower quality of life may retain their inhabitants whose work arrangements may not change. This can result in further divisions between people where privileged workers can freely move to desired locations, while those whose work will not adapt would be less flexible to choose where to live. This can result in communities in suburbs or specific parts of cities where 'traditional' workers are concentrated, while the 'remote workers' can be concentrated in other more popular areas. This can lead to challenges in social cohesion and the need to adapt urban planning to facilitate proximity between jobs, services, and residential areas. This would ensure better living conditions and can contribute to improved quality of life.



The outlined effects of this trend suggest that less space will be required for offices, due to the increased remote working solutions. As a result, the land use impact estimate is restrictive for *Built-up area-Industrial area and offices*. The increased flexibility to choose a living location can lead to increase of the demand for space in certain locations as well as demand for larger residential spaces to accommodate the more time spent at home. Areas with high quality of life can become more attractive to remote workers while others can decline. Cross-border regions can also experience shifting demands on the housing market in case cross-border commuters decide to settle on either side of the border to benefit from better housing prices and conditions, tax regulations or better quality of life. As a result, the land use impact estimate for *Built-up area-Residential* is expansive. Less commuting will affect transport behaviour, however, it is difficult to estimate if this will lead to lower need for transport infrastructure. Therefore the land use impact estimate for *Transport (incl. waterways)* is inconclusive. Figure 8 outlines the summarised potential effects of T2- Working from anywhere on land use. Further details for the trend can be found in Annex 2.

Figure 8-Land use impact estimate of T2-Working from anywhere



Interrelations with other trends and policies

The trend is effectively enabled by the existence of Internet connectivity in different settings and places, which is one of the objectives of the CEF and is covered under policy objective 'TEN-Telecom' (P4.3.). Additionally, trend element 'Flexible work arrangements' (T2.1.) has a reinforcing effect with trend element 'Digital alternatives' (T3.3.) in terms of technological advancement that can facilitate remote activities. Lastly, like all digital policies and trends, the trend is related to the digital divide as it pertains only to work that is suitable for remote working which may create further division in the labour market, especially for disadvantaged groups with lower chances. Consequently, this can fuel dissatisfaction and further division and contribute to trend Tyranny of merit (T5).

5.2.3 Accelerated digitalisation and omnichannel futures (T3)

Trend T3 – Accelerated digitalisation and omnichannel futures outlines the possible implications of the increasing penetration of technology and Internet in different spheres of life. It includes the effects of this technologisation on health and education, leading to market transformation and change in the provisioning of those services. In addition, it also encompasses societal changes pertaining to the wider utilisation of technology for entertainment and free time. Lastly it also includes the further advancement of online trade as one of the most established sectors that has adapted to digital and online solutions.

Trend element 'Technology in health' (T3.1.) focuses on healthcare and the wider adoption of technology for prevention, monitoring, consultation, and treatment. From the perspective of medical care, the advancements in technology are expected to improve healthcare outcomes, better and new treatments and improved prevention policies. These changes will match changes in societal behaviour including the adoption of technology for monitoring that people will utilise. The higher collection of data on the health condition of people will allow for better monitoring and more targeted policy actions in this field. The more straightforward digitalisation aspect of healthcare includes the remote consultation and treatment options. Thanks to Internet and improved connectivity, accessing healthcare can be done remotely, thus minimising the need to travel to access those services. This can increase overall quality of life and lower the demand for local provisioning of healthcare services. The economic implications of this increased digitalisation can also lead to growth in the health-tech industry, especially in established technological and health centres. As a result, more demand for industrial and office space can be expected.

Trend element 'Technology in education' (T3.2.) outlines the effects of wider adoption of digital solutions in education, including remote education. As observed during the Covid-19 pandemic, education quickly shifted to remote solutions, minimising the need for pupils and students to attend in-person classes. The further development of these practices can lead to lower need to physically attend classes in universities and schools, which can lower the need for people to commute or travel for educational purposes. Universities may be able to provide education to more people through the new remote educational formats. The other aspect of this trend element is the increased access to information online with new educational forms accessible to the public through online platforms and social media. Increased access to information and resources online can make people more informed on different aspects and decrease interest in traditional forms of education. This can also have downsides as the ubiquity of information



can decrease the sensitivity to misinformation and make people more susceptible to misleading and manipulative messages (this can lead to the isolation of different social groups and more radical positions on key issues, depending on the concentration of information sources that the groups utilise; this isolation can further fuel inequalities and divisions, see also Trend 5 – Tyranny of merit). The further expansion of these solutions will open new market opportunities and further contribute to the rise of ed-tech sector. The growth of this sector can generate higher demand for industrial and office space.

Trend element 'Digital alternatives' (T3.3.) focuses on the wider adoption of digital alternatives to physical reality, such as Augmented Reality and Virtual Reality (VR). New solutions will be produced for entertainment that can lead to increased time spent indoors and even less travelling, thanks to virtual and remote 'vacations' facilitated through VR. People can spend more of their free time at home. With the increasing possibilities to work, play and access information and entertainment remotely and through digital solutions, people may need to travel less to access different services and activities and as a result, this may lead to increased demand for residential space in order to accommodate the different activities performed at home.

Trend element 'Online trade expansion' (T3.4.) outlines the further expansion of online trade as the predominant form of commercial activity. Online shopping and commerce can continue to expand globally. International commercial platforms can continue their growth, allowing people to order products from different places in the world and having them delivered to their doorstep. This tendency will contribute to the further growth of online sales industry. At the same time, traditional forms of physical commerce may decline further, including as social spaces for interaction as people spend more time at home.

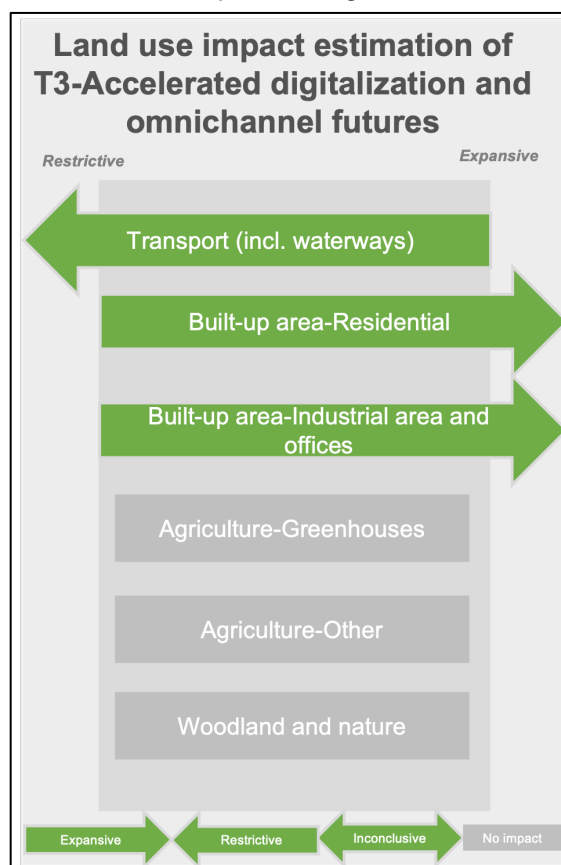


Figure 9-Land use impact estimate of T3-Accelerated digitalisation and omnichannel futures

The effects of the increased digitalisation of economy and life illustrated in this trend suggest that the technological industries, such as health-tech, ed-tech, and online commerce, will continue to grow. As a result, this can lead to new market opportunities and more jobs in those fields. It is likely that already established cities and regions with concentration of technological businesses can be in a better position to accommodate this growth. The increase of global online trade can lead to further demand for cross-continental transportation, thereby increasing the importance of large ports for cargo shipments. All these anticipated effects on economic growth suggest expansive effects on *Built-up area-Industrial area and offices*, especially in places where technological industry or global ports operate. The increased



remote accessibility of services, such as health, education, and entertainment, suggests that more time will be spent at home, thereby increasing the demand for residential space, including the demand for larger residential units to facilitate the diverse activities at home. As a result, the anticipated land use impact is expansive for *Built-up area-Residential*. This accessibility, however, is going to affect disproportionately different regions, depending on their level of connectivity to the network – a digital divide can occur between well-connected places and such without connectivity. The reduced need for travelling to access services also suggests less demand for transportation and therefore restrictive effects on *Transport (incl. waterways)* land use. Figure 9 outlines the summarised potential effects of T3 – Accelerated digitalisation and omnichannel futures on land use. Further details for the trend can be found in Annex 2.

Interrelations with other trends and policies

Trend T3 has a reinforcing effect on trend Working from anywhere (T2) due to the development of technology that can enable remote activities. The trend is overall related to policy Europe Fit for the Digital Age (P5) and is also enabled by it – the more digitalised Europe becomes, the greater the chance for this trend to advance. The expansion of digital infrastructure captured by policy objective ‘TEN-Telecom’ (P4.3.) is an enabling factor for the trend.

5.2.4 Global geostrategic plans of others (outside of Europe) (T4)

The premises of trend Global geostrategic plans of others (T4) are based on the idea of a multipolar world (as opposed to East-West division in the Cold War). Respectively, due to the multipolarity, the trend elements represent potential internationally relevant developments in key regions of the world (outside of Europe) or geopolitical interests and decisions that can have influence on the world, and the EU respectively. The effects are anticipated from EU perspective. Due to the diversity of the trend elements, pertaining to specific decisions or possibilities in different parts of the world, it is recommended that this impact estimate is viewed separately for each trend element, despite the possibility of overlaps between some of them. The trend includes an increased protectionist policy of the US and China in the context of their continuing competition (especially for the semiconductor, tech and raw materials industries); the increasing influence of China (and Russia) on developing countries, especially in Africa, as part of the challenging of the established international order; an escalation of the conflict between India and Pakistan; US military intervention in Iran as a proxy of the instability of the Middle East; increased cooperation between QUAD (Indo-Pacific region) and the West, including the EU.

Trend element ‘US and China tech supremacy’ (T4.1.) outlines the potential effects of the continuing competition between the two global powers in technology, including the semiconductor industry. Due to the ubiquity of technology, this industry has a geostrategic importance. The trend represents the opposite hypothesis of policy objective ‘EU semiconductor leader’ (P5.1.). This policy objective illustrates the ambition of the EU to become a major global player in the technology sector, specifically in the semiconductor industry. Trend element T4.1. outlines the possibility of the reverse scenario where the EU is side-tracked due to the increasing influence of the US and China. Respectively, this trend element also outlines the effects of the interruption of coordination with the US in this field. As a result of the increased influence and global market share of US and China in the technology sector, it is



expected that US investments in the EU will decrease. EU economy will become more dependent on imports, specifically for semiconductors. The existing cooperation between the US and the EU will decrease and this will lead to lower foreign investments of US capital in the EU semiconductor and technology industry. As a result, economic decline may be experienced by existing clusters in this industry. This will more likely impact locations with established businesses and ecosystems in the technology and semiconductor industry. This decline, however, will likely be temporary as businesses will manage to adapt to the changing circumstances. The favourable economic policies supporting the technology sector will result in better conditions for business and it is expected that they will manage to compensate the impact and identify new opportunities for growth. The effects of trend element T4.5. (QUAD cooperation) can also support this. As a result of this economic growth trajectory, it is expected that the demand for industrial areas and offices will increase, especially in growing and economically strong locations.

Trend element 'China and Russia influence' (T4.2.) illustrates the increasing influence of China and Russia in different regions of the world, most notably in Africa. As part of the challenging of the established international order, not least illustrated with the war of Russia on Ukraine, the two countries are using different instruments to achieve increased influence in unstable global regions, such as Africa. In Africa, these instruments often include large-scale investments or support for and with paramilitary formations, challenging potential democratic transitions in developing countries. Fragile governments in Africa become indebted to China with large-scale infrastructural projects financing. Their resources, especially for critical raw materials, such as cobalt, are of key importance to the green and digital transition. As a result of the increased influence of non-democratic countries in regions such as Africa, the fragile cooperation agreements for exports and trade can be jeopardised due to political instability or war (as the recent example with Sudan has shown). As a result of the increasing and continuing political and social instability of Africa, it is expected that more people will attempt to flee conflict or fragile regions and thus increase migration pressure north. The EU remains a desired, and sometimes the only, possible destination for these people and this can trigger further challenges for the migration policy of the EU. The larger influx of refugees will create challenges for public support systems and will require active management of housing allocation and services. As a result, it can be expected that an increase in the demand for residential land would occur.

Trend element 'India-Pakistan conflict' (T4.3.) outlines the possibility of further military confrontation between India and Pakistan in the Kashmir region. The conflict has a long history, but its potential escalation can have consequences globally due to its scale and because both countries are nuclear powers. This could trigger quick interventions by Western powers to avoid further escalation. As a result, public spending in defence can increase and established military locations nationally may gain further importance. The increasing instability in the conflict region could result in large migration waves towards the EU, in addition to already existing migration pressure. As a result, this would create challenges for public support systems and would require active management of housing allocation and services. Consequently, an increase in the demand for residential land may occur.



Trend element 'US-Iran confrontation' (T4.4.) outlines the possibility of a military conflict in the Middle East, specifically a confrontation between the US and Iran. A number of events, not least the assassination of a highly ranked Iranian general in 2020, have foreshadowed the possibility of this escalation. Communication between the two countries continues to be confrontational. In case a political shift in the US occurs in the upcoming elections, the possibility of such a conflict could increase. As a result, this could lead to further migration waves towards the EU from the Middle East, challenging public support systems and require active management of housing allocation and services. Consequently, an increase in the demand for residential land could occur.

Trend element 'QUAD cooperation' (T4.5.) outlines the possibility of increased cooperation with the Indo-Pacific region. The region has geostrategic importance as the US is looking to counteract Chinese influence there. Respectively, active measures are taken to improve cooperation and stability with India, Australia, and Japan. It is expected that the increased cooperation between those countries and the West can increase economic cooperation and deepen established partnerships. From an EU perspective, this can result in increased investment flows between the EU and the above countries. This could lead to increased voluntary migration between the two global regions, especially in key industries such as technology. As a result, it is expected that well-established cities and regions with more employment in those fields would become more attractive for expatriates. As a result, increased demand for residential space can be expected. The increased investment flows can also result in higher demand for industrial and office space, especially in growing cities with strong positions in the above sectors.

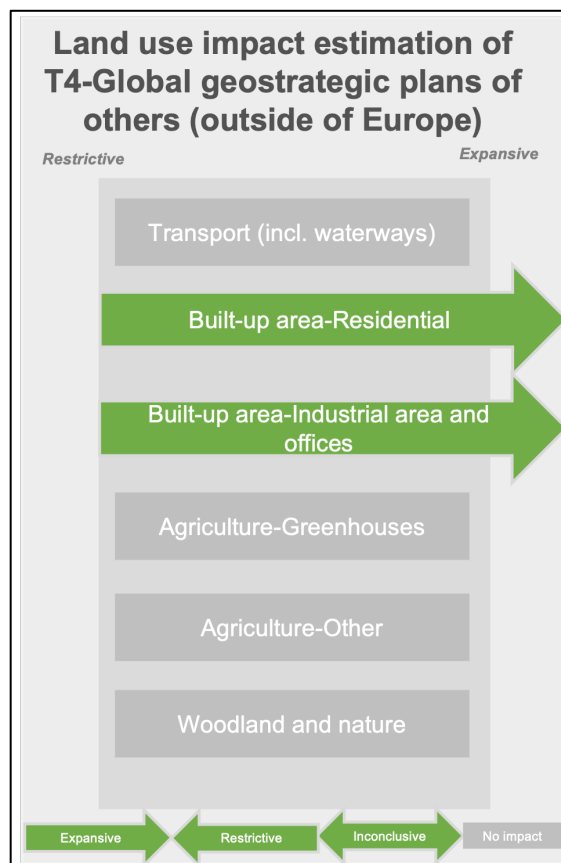


Figure 10-Land use impact estimate of T4-Global geostrategic plans of others

As a result of the anticipated effects of this trend, from EU perspective it is more likely that multiple factors can influence migration patterns towards the EU. Any potential conflict or instability in Africa, the Middle East or Asia could increase involuntary migration. This would create challenges for receiving countries, especially in terms of housing. Larger cities may be preferred due to better perceived opportunities for livelihoods. This can affect them disproportionately and they may have challenges allocating residential space for large groups of migrants. Active migration management may result in targeted resettlement of refugee groups in less populated regions and to thus offset pressure on popular urban areas. This can increase the demand for residential space in less populated regions or less popular locations as well. As a result, the anticipated effect on *Built-up area-Residential* is expansive as more space will need to be allocated for housing, both temporary and long-term, of new population



groups. At the same time, increased investment activity, either as a result of the adaptation to changing global technology powers (trend element T4.1. 'US and China tech supremacy') or as a result of new trade and economic partnerships will also likely result in increased demand for business and industry space as new investment may result in expansion of existing facilities or the construction of new ones. Thus, the expected impacts on land use are expansive for *Built-up area-Industrial area and offices*. Figure 10 outlines the summarised potential effects of T4 – Global geostrategic plans of others (outside of Europe) on land use. Further details for the trend can be found in Annex 2.

Interrelations with other trends and policies

Trend element 'US and China tech supremacy' (T4.1.) represents the reverse hypothesis of policy objective 'EU semiconductor leader' (P5.1.) where the EU does not manage to achieve it. Trend element 'QUAD cooperation' (T4.5.) has reinforcing effects with policy objective P5.5. (EU strategic autonomy and US) where it can contribute to the strategic autonomy of the EU in terms of critical materials supply. This can have indirect effects on policy objective 'Circular value chains' (P2.3.) with improving the reutilisation of materials internally to the EU as part of circularity efforts.

5.2.5 Tyranny of merit (T5)

Trend T5 – Tyranny of merit is based on the idea, expressed in the work of the same name by Michael Sandel (Sandel 2020). The idea outlines the negative effects of a merit-driven economy and politics that continuously marginalise and decrease the chances of some social groups and disregard the systemic challenges that they face. The idea offers a critique of the merit-contribution aspect of capitalism in its current form and argues for solutions. It outlines the possibility of exacerbating existing inequalities and lack of equity in societies. The trend is not universal and can manifest differently in diverse national or transnational contexts (e.g., the EU). These divisions and deep ruptures between social groups can also have territorial dimensions and solidify certain regions, cities, neighbourhoods or even countries (from EU perspective) as places with a disadvantaged position that can be stigmatised. From a social perspective, this can have effects on the personal life trajectory of citizens whereas social chances would be difficult to change due to the solidified predetermination of those as a result of upbringing, social class and insufficient resources due to intergenerational poverty, for instance. As a result, three trend elements have been defined: increasing income inequality; increasing inequality of opportunity and concentration of resources in private capital, inequality in labour markets and lower social mobility.

Trend element 'Income inequality' (T5.1.) outlines the possibility of continuing increase of income inequality on national and global level. As a result of this trend, social groups with better economic chances (upper-middle- and higher-class families) will continue to have better material chances. The accumulation of wealth for them will continue. In parallel, social groups with lower social chances, such as people coming from families with intergenerational poverty or disadvantaged groups, will continue to struggle to make ends meet. These divisions can be territorially distributed. People living in certain poorer regions or countries will not be able to improve their material wellbeing due to the systemic challenges that they face and the inability to break the glass ceiling in their life trajectory. As a result, further concentration of poverty can occur in poorer regions, developing countries or specific neighbourhoods in bigger cities. At the same time, parts of those social groups may attempt to move to



wealthier countries within the EU and highly developed regions within countries in order to attempt to overcome the systemic challenges that they face. Consequently, increased demand for residential land can be expected in those growth centres at the expense of less wealthy regions.

Trend element 'Inequality of opportunity' (T5.2.) outlines the effects of the worsening of the existing inequalities in terms of access to housing, social services, as well as fewer social chances. Systemically disadvantaged groups may not be able to afford to buy housing due to the ever-increasing costs. At the same time, the concentration of poverty in certain regions will create challenges for social security systems and put pressure on public budgets. In parallel, wealthier social groups with better social chances will continue to have higher chance to access better services and better housing, especially in developed regions and cities. The tendencies for financialisation of the housing market, turning housing into a commodity and a financial asset, will continue. This will lead to further construction and densification of larger cities with higher-class residential areas with better amenities, affordable only for the selected few. Consequently, housing prices will continue to rise, further excluding the disadvantaged social groups. The increasing construction of high-end residential areas and the tendency for real estate investment will increase in bigger and growing cities, leading to further demand for residential space.

Trend element 'Inequality of labour' (T5.3.) outlines the effects of the differentiation in economic activity and labour market hierarchy, influencing the social mobility of different groups. As a result of the continued growth and concentration of capital in lucrative and highly profitable industries (e.g., finance, real estate), workers in these industries will have a better chance of finding jobs. At the same time, blue collar workers will have limited options for work as their role in the labour market is predetermined by their background or education outside of elite educational institutions. Consequently, the disadvantaged social groups will have lower chances to acquire better education to increase their social mobility and potentially find a better paid job. The concentration and further expansion of high-class industries and labour in growth-pole cities and regions can come at the expense of less-developed regions, further exacerbating the concentration of disadvantaged social groups in those. As a result, more investment activity and labour opportunities will be available in developed regions, increasing the demand for industrial and office space there at the expense of less-developed regions that will continue to decline, thus lowering the demand for industrial and office space there.

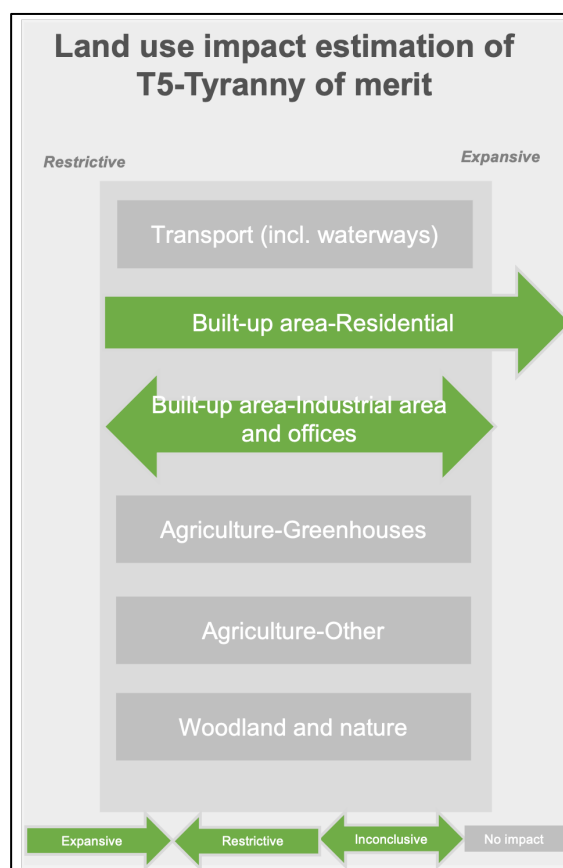


Figure 11-Land use impact estimate of T5-Tyranny of merit



As a result of the effects of the three trend elements in this trend, it is expected that developed cities and regions (nationally) and developed countries (in the EU and internationally) will continue to grow, but without being accessible to wider social groups. The lowered social chances of some parts of society can result in territorial concentration of poverty and decreased social mobility in lagging regions, less-developed countries, or poorer cities. This concentration can fuel increased migration to growth poles as people will struggle to overcome their disadvantaged position. As a result, increased pressure on housing will occur in growing regions, further complemented by increased investment in real estate there (financialisation of housing). Therefore, the expected land use impact on *Built-up area-Residential* is expansive. The concentration of investment in growth-poles will continue to increase the demand for new industrial and office space in more developed territories, while less-developed ones will continue to decline. Therefore, the expected land use impact is inconclusive for *Built-up area-Industrial area and offices*. Figure 11 outlines the summarised potential effects of T5 – Tyranny of merit on land use. Further details for the trend can be found in Annex 2.

Interrelations with other trends and policies

Trend T5 (Tyranny of merit) can be influenced by different dimensions of inequality that result from the effects of other trends and policies. The digital divide, outlined in policies CEF (P4), Europe Fit for the Digital Age (P5), trend Working from anywhere (T2), and trend Accelerated digitalisation (T3) can disproportionately affect social groups that do not have access to digital solutions or to the Internet. This can be particularly severe in the hypothesis of increased dependence on e-health and e-education ('Technology in health (T3.1.) and 'Technology in education (T3.2.) respectively). The investments in digital infrastructure can result in isolating some places. Furthermore, social pressure and dissatisfaction can be fuelled by the expected increased cost of food, transportation, housing, and energy as a result of the green transition (policy P1 – EGD and trend T1 – shift to renewables) that can disproportionately affect disadvantaged social groups.

5.3 Cross-analysis and consolidated estimate of impact of EU policies and global trends

The reviewed EU policies and global trends suggest different ways of impacting land use. Some of the policies indicate direct land use impact with envisioned expansion or restrictions of certain land use types. These mostly pertain to the green transition. For other policies and trends, the potential land use impact is as a result of market transformation or economic processes. Lastly, further effects on land use can also be triggered by social behaviour change and migration.

Potential direct land use impact

Some policies and trends have direct implications on land use as they envision the expansion or restriction of some of the land use types, reviewed in this study. The European Green Deal (P1) and the policies aligned with it (P3 EU Biodiversity strategy and P4 CEF) anticipate direct impacts on different types of land use:



- More agricultural land use will be needed to achieve the transition to organic agriculture (P1-European Green Deal and its objectives 'More sustainable food production' and 'Improve the condition of the environment'). This will be further supported by the objectives of the EU Biodiversity strategy (P3) and its objectives 'Protect nature' and 'Restore nature', also stipulating increase in agricultural land. The expected expansive effect is valid for both *Agriculture-Other* and *Agriculture-Greenhouses*.
- More natural land use will be needed to achieve the ambitions of the European Green Deal (P1) and the EU Biodiversity strategy (P3). The policies are oriented to one objective – the goal to restore and expand protected areas and ecosystems.

The ambitions of the European Green Deal (P1) and its aligned policies on the expansion of agricultural and natural land also imply that the built environment should not be expanded or at least not at the expense of agricultural and natural areas. This can create a challenge, especially for densely populated cities and regions, where expansion and sprawl might be either easier or preferred. At the same time, the ambitions, and targets to expand natural and agricultural areas will need to be considered at national level. This will require decisions for trade-offs of land at national level while at the same time creating challenges on local level, especially in regions with proximity between built and natural areas (see also Figures 16, 17 and 18 at the end of the section).

The EU ambitions on transport also anticipate direct effects on land use. The European Green Deal (P1) sets the overall ambition of achieving a transition of the sector by increasing the share of railway and water transportation at the expense of coach and air transport:

- More transport land use will be needed to facilitate the expansion of railway corridors and waterways. Apart from the overall ambition of the European Green Deal (P1) this expansion will also be realised through the specific projects, financed from the Connecting Europe Facility (P4).

The expansion of transport land use will have different effects on the regions, depending on the current state of their infrastructure. More connected places with well-established transport infrastructure and strategic location (nationally and internationally) can maintain and potentially expand their infrastructure to facilitate their continuing role as a transport centre. Regions with lower coverage of transport infrastructure can acquire new links through concrete projects. Some of those projects are part of the TEN-T networks (P4 – CEF) (see also Figure 13 at the end of the section).

As a significant component of the green transition of the EU, the energy transition ambitions can also have direct impacts on land use. The transition to renewable sources of energy production is outlined in the European Green Deal (P1) as well as in the TEN-E network, part of the Connecting Europe Facility (P4). The policies are aligned and highlight the specific ambitions to construct new renewable energy production sites and to improve the connectivity between countries in the EU in order to achieve an integrated energy market. The ambitions of those policies are also supported by trend Shift to renewables (T1).

- More land will be needed to construct renewable energy sources. For larger-scale projects, this may require land allocation outside of built areas (through land conversion) or conversion of



underutilised built areas or through dual land use (e.g., agrivoltaics). Since the new energy sites must be closer to the grid and consumers, to decrease transmission costs, it is likely that more pressure will be placed to convert agricultural and natural land to create space for renewable energy sources and supporting infrastructure.

- In the built environment, the adoption of more renewable energy can be facilitated through the utilisation of the existing building stock (e.g., rooftop solar) through small-scale solutions. This can create pressure on residential land, especially for new projects, as building and residential areas design and size may need to be adjusted to incorporate space for renewables.

The allocation of space for renewables will depend on local, regional, and national plans and will require tailor-made approaches to different areas. Small-scale solutions within industrial zones or residential areas may be more flexible in terms of space demand. Figure 12 illustrates the potential direct land use impacts of the reviewed policies.

Potential land use impact as a result of economic shifts and market transformation

A large part of the potential land use impact can be triggered by market changes and envisioned market transformation (including consumer behaviour change). One of the main transitions envisioned is

the one to circular economy, outlined in the Circular Economy Strategy and Action plan (P2). The transformation of production to more circular patterns is expected to redefine supply chains and decrease pollution through the reuse and recycle of waste, including from industrial production. The supply chain aspect of this transition can prompt the creation of new industrial zones or the reorganisation of existing ones in order to enable shorter distances between production facilities. This

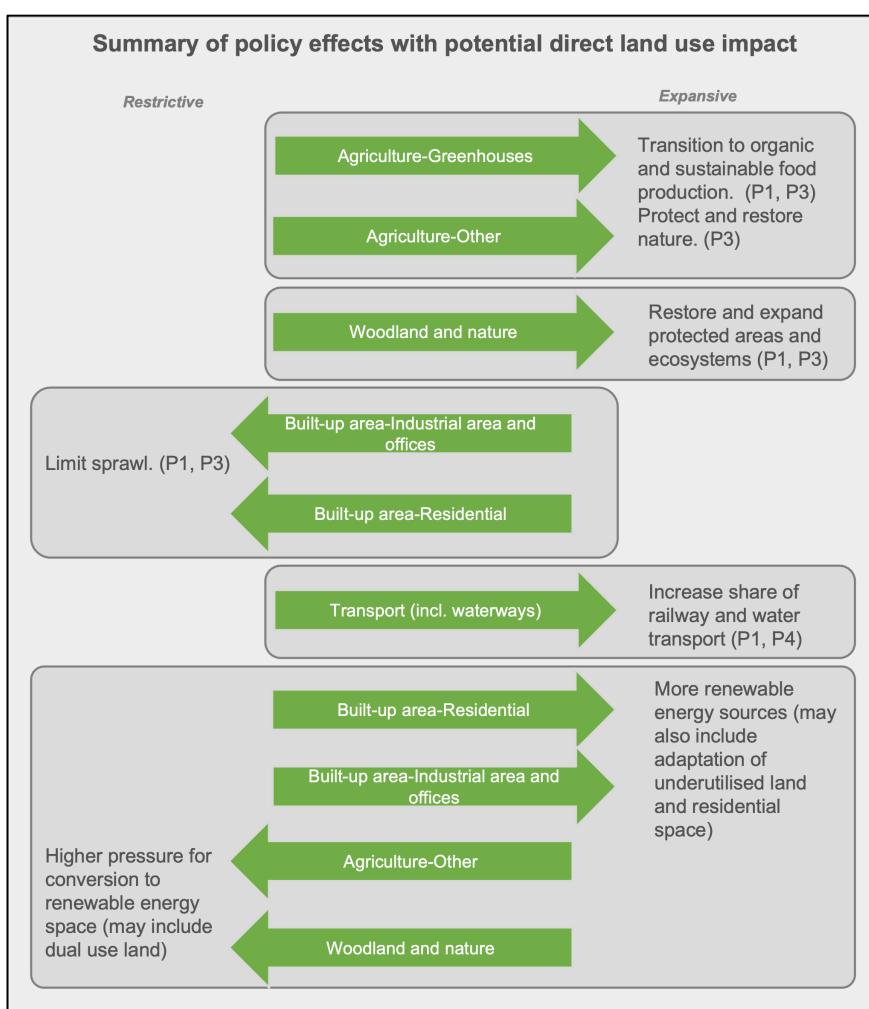


Figure 12-Summary of policy effects with potential direct land use impact



proximity can support the envisioned increase of resource reutilisation between businesses. At the same time, the overall transition to new forms of production is expected to generate new business opportunities and this can lead to new economic activity zones:

- Increased land demand for industrial areas can occur in order to facilitate new production facilities for circular economy. The transition may result in new forms of industrial areas with more proximity between businesses and facilities. At the same time, it can also result in the establishment of new economic zones.

Another key sector whose market transformation can generate land use impact is technology. This sector is understood in a broad sense, encompassing research and development, hardware, and software industries. This can include the production of semiconductors and chips, among other, as well as digital and online businesses in software engineering or web design. This can also include specialised sectors such as ed-tech, health-tech, and AI. The expansion of the technology sector can also be complemented by the ambitions of the EU to increase its critical computing capacity, which will require the construction of new server locations and supporting infrastructure. The reviewed policies and trends indicate that these sectors can experience further growth due to their prioritisation on policy level and due to their geostrategic importance:

- Increased land demand for industrial areas and offices can be expected because of the growth of the technological sector. This growth will likely occur in cities and regions with already established technological industries due to the concentration of talent and investment. University locations or established educational or healthcare centres could be an enabling factor for the expansion of some of the technological fields due to more opportunities for partnership in research and development.
- The growth of the technological industry and the subsequent land demand can also be fuelled by increased investment flows from the US. Closer cooperation with the US is a factor specifically for the semiconductor industry and its expected growth, especially in highly competitive regions of this industry. The growth of this industry, however, is susceptible to global shifts – for instance, if US and China become the global leaders in this industry. If this happens, the growth prospects may be less likely.
- Increased land demand for industrial areas could also be triggered by the construction of new critical computing infrastructure. Due to its strategic importance and vulnerability, this infrastructure will need to be built in inland areas with stable climate and lower risk of disasters. These locations will also require qualified specialists, which can be an additional factor for choosing the location.

Another specific land use impact effect can be expected on ports. Major harbours can be influenced by global economic flows and their importance can change, depending on the demand for cargo shipments. The analysis indicates that global trade can continue to increase (as a result of global online commerce increase, outlined in trend Accelerated digitalisation (T3)). Additional factors for international trade flows can be the partnerships with the US and other economic blocs (such as QUAD). The role of ports should be viewed from an EU perspective in the context of this study as the Netherlands is a leading maritime transport country. Even though the circular economy transition can decrease the need for imports from



outside of the EU, global freight traffic is unlikely to decline. As a result, established ports and their supporting land transport infrastructure to them will remain of strategic importance:

- Increased land demand for industrial areas for port infrastructure can be expected in order to facilitate the global freight transport demand. The expansion of each port area will depend on its market strategy and positioning to competitive port locations. Strategic EU and global ports, such as Rotterdam, will likely have an advantageous position.

The expected land use impact from economic activity and market transformation¹² will largely depend on the competitiveness of locations. More established economic centres will likely experience further growth at the expense of declining regions. Less developed regions can still attempt to use some of the anticipated economic shifts to identify new growth opportunities (see also Figure 15 at the end of the section).

Potential land use impact as a result of social behaviour change and migration

Some of the anticipated land use impacts could result from social behavioural change, personal preferences by social groups or by circumstances that create challenges for larger groups of people. As a result of some of the outlined market transformations above, more employment opportunities can become available. This specifically concerns the technological sector and the renewable energy sector. New employment opportunities will likely be concentrated in larger cities or regions where the industry is already established and will continue to grow. As a result, people might be willing to reallocate to those places for professional reasons and this can increase the impact on residential space (see also Figure 14 at the end of the section):

- Increased land demand for residential space in growing cities and regions due to labour migration, especially in competitive places in the technological industry and its supporting ecosystem.

Labour migration is only one factor of the migratory patterns that can result in land use impact. Increased socioeconomic divisions within countries and between countries can also fuel migration to larger cities as people may pursue better chances there. This can occur at the expense of less developed regions which might lose population. At the same time, international migration can be influenced by increased economic flows between countries but also by humanitarian crises and conflicts:

- Increased land demand for residential space in growing cities and regions due to higher voluntary and involuntary migration pressure. Less demand for residential space in lagging regions unless there are proactive policies to handle involuntary migration.

The increased digitalisation of life and access to technology in spheres, such as health, education, entertainment, and work, can result in increased preferences to spend time at home. More people may

¹² Market transformations also depend on consumer behaviour change.



choose to work from home and to avoid travelling to access services. Demand for larger residential units may increase in all locations. Living conditions and quality of life will become more important:

- Increased land demand for more and larger residential spaces can occur as people will spend more time at home due to more opportunities for remote and online activities. More demand is likely in places with a higher quality of life as they become more attractive.

Socially driven land use impact can be slower to occur and can be part of larger population trends. Humanitarian crises are an exception as they can trigger larger migration waves in a shorter period of time.

Further overlaps between factors of land use impact

Based on the identified estimates on the sectoral impact of EU policies and global trends as well as on their potential impact on land use, it can be concluded that the overlapping effects of the different policies and trends align with the thematic grouping presented in the beginning of the chapter.

The ambitious EU objectives, formulated under the European Green Deal and its related policies, together with the analysed trend on increasing shift to renewables indicate a significant demand for land to facilitate this change. The ambition for expanding protected areas and improving biodiversity reserves directly implies limiting the expansion of built-up areas and expanding or preserving natural areas and agricultural land. This shift may create a continuous tension between urban and industrial areas and non-built-up space, thus creating conflicts and challenging planning conditions in different regions. While rural areas may be in a more favourable position in terms of natural and agricultural land shares, major urban centres may be faced with the challenge to keep expanding their available space while at the same time preserving natural space and not convert agricultural land to built-up area. This can result in further increase of densification and subsequent challenges on urban level as well as conflicts on regional level. Within cities, these challenges can be overcome with more multifunctional use areas and regeneration and revitalisation of vacant spaces.

Changes in transportation will also result in impacts on land use as new land transportation, predominantly railways, will need to be built. This may lead to continuous demand for transport land use and conversion of land to facilitate this new infrastructure. In the context of the reviewed policies, this will likely occur in strategic transport locations and the TEN-T network. At the same time, some trends and policies imply shorter travelling times and shorter supply chains. This could balance the need for extension of transport infrastructure by adjusting the demand.

The estimates that encompass economic transitions and processes (e.g., circular economy, key industries, global trade) imply unbalanced effects on different territories. Established economic centres may gain further competitive advantage and continue to attract capital and people at the expense of less developed regions and cities which may lose this competition (unless they find a way to take advantage of it). As a result, the land use effects could be disproportionate. Established economic centres may see further pressure to expand their industrial areas (and as a secondary effect, their residential land due to increased influx of people to the city) while the regions left behind might



experience less pressure for such land. Some policies and trends were also identified as having the potential opposite effect of increasing activity in more rural and agricultural regions (e.g., technological advancements in agriculture, remote working trends). They may have expansive effects on residential or agricultural land in those regions.

The importance of key economic centres is also highlighted by the effects of policies and trends that have a global dimension. Potential increases in global trade or improved global competitiveness of Europe place a specific emphasis on port locations or territories with key technical infrastructure or know-how, making them more susceptible to global shifts.

Figure 13 shows the interrelations between the different policies and trends reviewed. The European Green Deal (P1), as a high-level policy, has an enabling effect on its subordinate policies on EU Circular Economy strategy (P2) and EU Biodiversity strategy (P3). It also enables some parts of the CEF (P4). These policies support the overall environmental transition in the EU and are reinforced by trend Increasing shift to renewables (T1). The construction of digital infrastructure as part of CEF (P4) is a reinforcing factor to the digital transition (P5 – Europe Fit for the Digital Age). The digital transition of the EU enables further the trends on accelerated digitalisation and working from anywhere (T3 and T4). The accelerated digitalisation also reinforces the remote working trend. The increasing digitalisation has influence on potential social divisions between groups as part of the digital divide. Access to technology can become a prerequisite for better opportunities or for accessing services. The digital transition and specifically some key industries, such as semiconductors, contribute to the global positioning of the EU. The latter, however, is also influenced by specific partnerships (such as with the US) and globally relevant events. Respectively, the EU also depends on those factors.

In conclusion, transport land use is expected to expand as a result of the effects of the European Green Deal (P1) to expand railway and waterways infrastructure. Further expansion can occur as a result of the completion of TEN-T projects (CEF-P4). Closer supply chains as a result of the transition to circular economy (EU Circular Economy strategy-P2) can decrease the demand for transport close and between industrial facilities. The more time spent at home as a result of the increased digitalisation (trend Accelerated digitalisation T3) can also lower the demand for travelling to access services or entertainment. The impacts on transport land use from trend Working from anywhere (T2) are inconclusive as their effects can be different in different territories. A visual representation of this can be found in Figure 14.

Demand for residential space is expected to increase as a result of improved transport connectivity, delivered by the increased investment in transport infrastructure as a result of the CEF (P4). The effects of those will be different, depending on how connected different regions are. More connected regions may experience increased demand. Less connected regions can experience decrease in demand of residential space. Better connectivity, economic growth in technology industries (policy Europe fit For the Digital Age – P5 and trend Accelerated digitalisation – T3), changing working arrangements (trend Working from anywhere – T2) can lead to higher demands for residential space, especially in well-developed regions and in places with higher quality of life. Adapting the built environment and residential buildings to utilise renewable energy sources (European Green Deal – P1 and trend Increasing shift to renewables – T1) can increase the demand for space for the construction of those sources and can also



lead to increase in the demand on residential land use. Increased migration pressure (Europe Fit for the Digital Age – P5 and trend Global geostrategic plans of others – T4), both voluntary and forced, can increase the demand for housing and, respectively, the demand for residential land use. Further societal divisions (trend Tyranny of merit – T5) can also lead to increase in residential space demand, especially in well-developed regions. The potential effects of the European Green Deal on residential land use are inconclusive as it discourages urban sprawl, but the improved connectivity can fuel expansion of suburban areas. A visual representation of this summary can be found in Figure 15.

Demand for industrial land use can increase as a result of the circular economy transition and the new opportunities for industries to grow in this area (Circular Economy Action plan and strategy – P2). The growth of the technology industry (Europe Fit for the Digital Age – P5 and Accelerated digitalisation – T3) can also increase this demand, especially in well-established centres. Increased global cooperation and investment flows can also fuel this demand (trend Global geostrategic plans – T4). With their ambitions to preserve the environment and natural and agricultural space, policies European Green Deal (P1) and EU Biodiversity Strategy (P3) are anticipated to have restrictive effects on industrial land use. Furthermore, the changing working patterns and increased adoption of remote working can decrease the demand for office space (trend Working from anywhere – T2). CEF (P4) and trend Tyranny of merit (T5) have inconclusive impact on industrial land use as some places may grow as a result of those while others can decline. A visual representation of this summary can be found in Figure 16.

Other agricultural land is expected to increase as a result of the European Green Deal (P1) and the need to allocate more space for organic and sustainable agriculture. This ambition is also outlined in the EU Biodiversity strategy (P3). Increased need for industrial and critical computing space (Europe fit for the Digital Age – P5) and the increased need for space for renewables (trend Increasing shift to renewables – T1) can have restrictive effects on agricultural land unless solutions such as dual use are found. The CEF (P4) has inconclusive effects on agricultural land as it is difficult to estimate how much the expansion of transport infrastructure can impact agricultural land. A visual representation of this summary can be found in Figure 17.

Greenhouse areas are expected to increase in order to support the transition to organic and more sustainable food production, outlined in the European Green Deal (P1) and EU Biodiversity Strategy (P3). A visual representation of this summary can be found in Figure 18.

Natural land is expected to expand as a result of the direct effects of the European Green Deal (P1) and EU Biodiversity strategy (P3) envisioning expansion and restoration of natural areas. As a result of the transition to circular economy (EU Circular Economy strategy – P2), it is expected that the environment will be less polluted, and this will further contribute to the expansion of natural areas. Increased need for industrial and critical computing space (Europe fit for the Digital Age – P5) and the increased need for space for renewables (trend Increasing shift to renewables – T1) can have restrictive effects on natural land. A visual representation of this summary can be found in Figure 19.

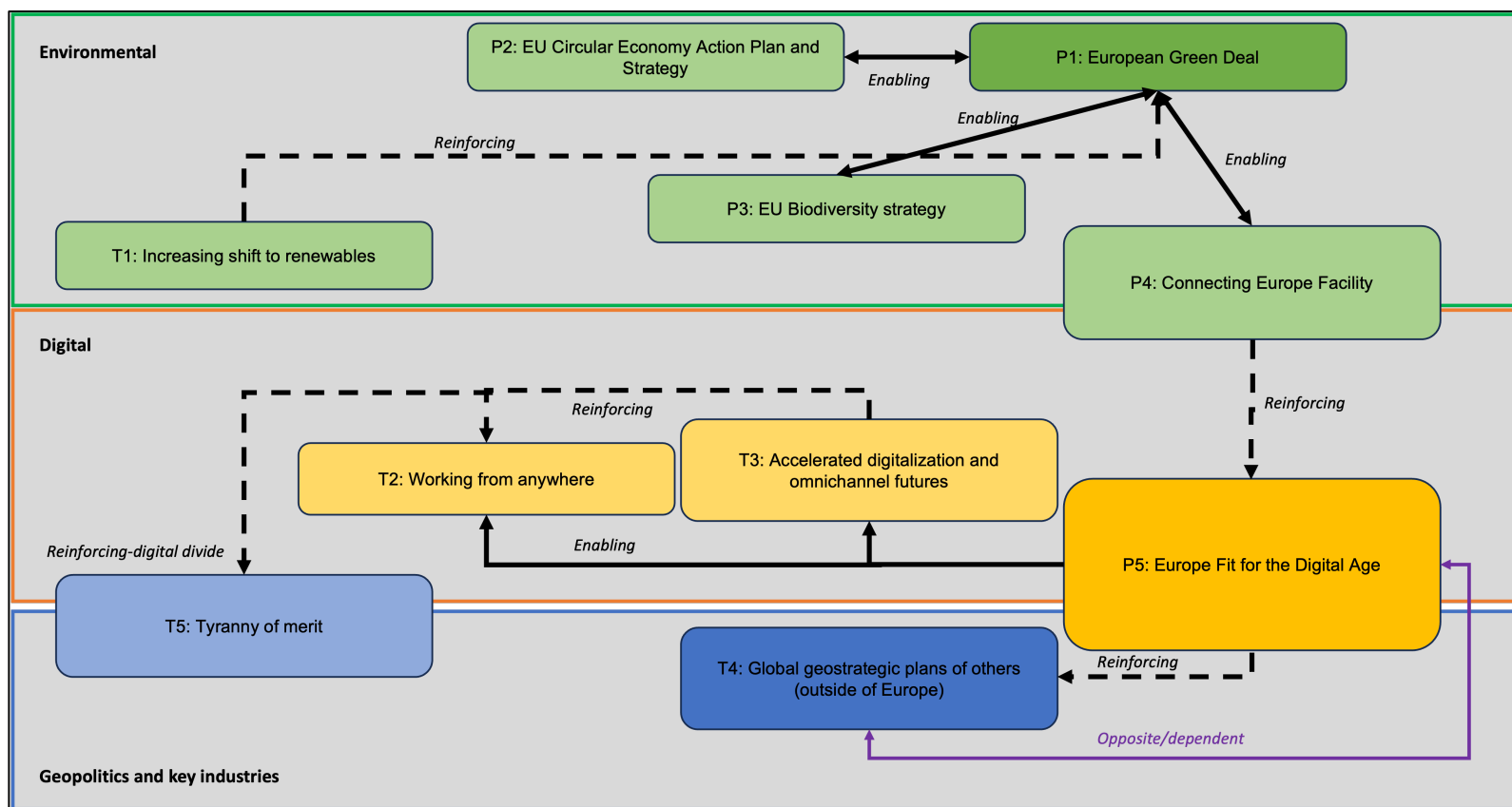


Figure 13-Interrelations between the reviewed EU policies and global trends

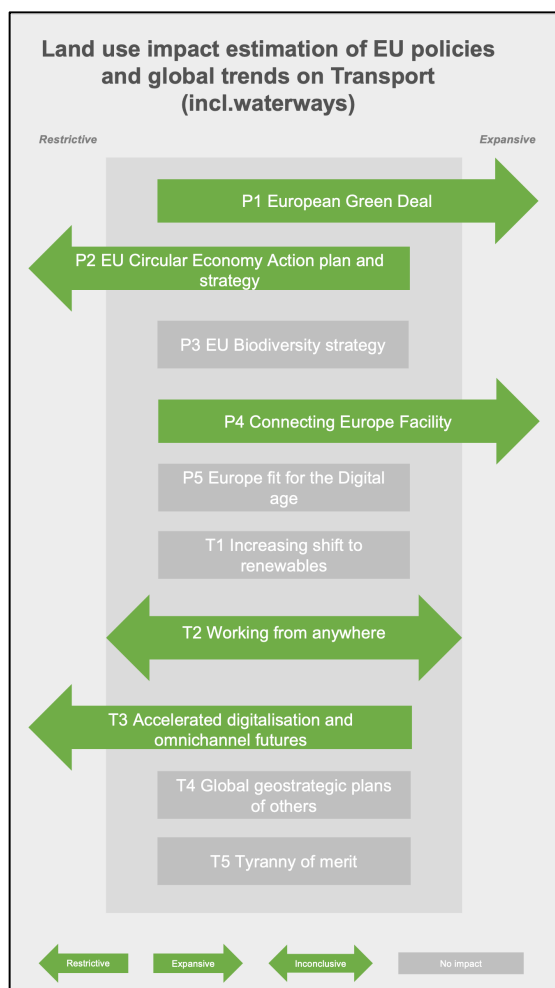


Figure 14-Land use impact estimate on Transport (incl. waterways)

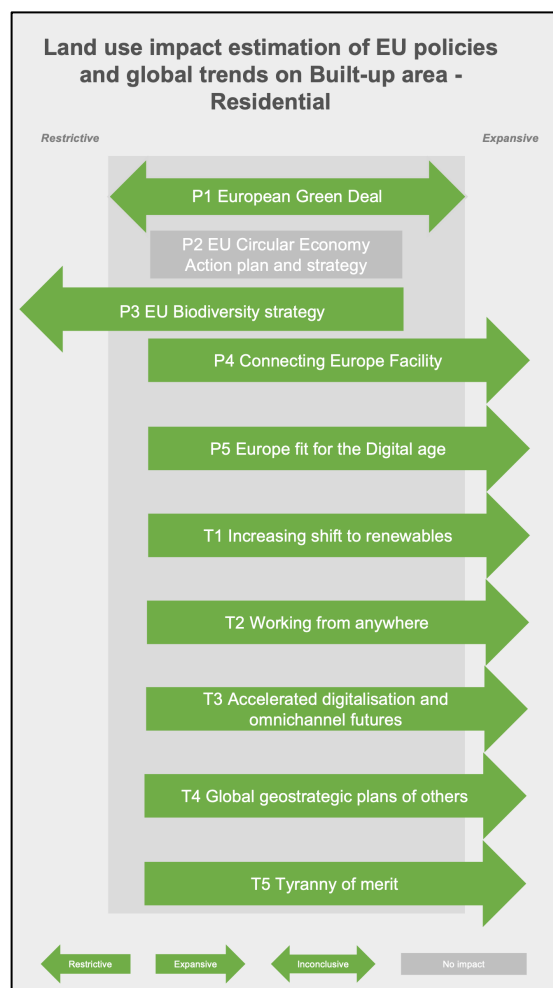


Figure 15-Land use impact estimate on Built-up area-Residential

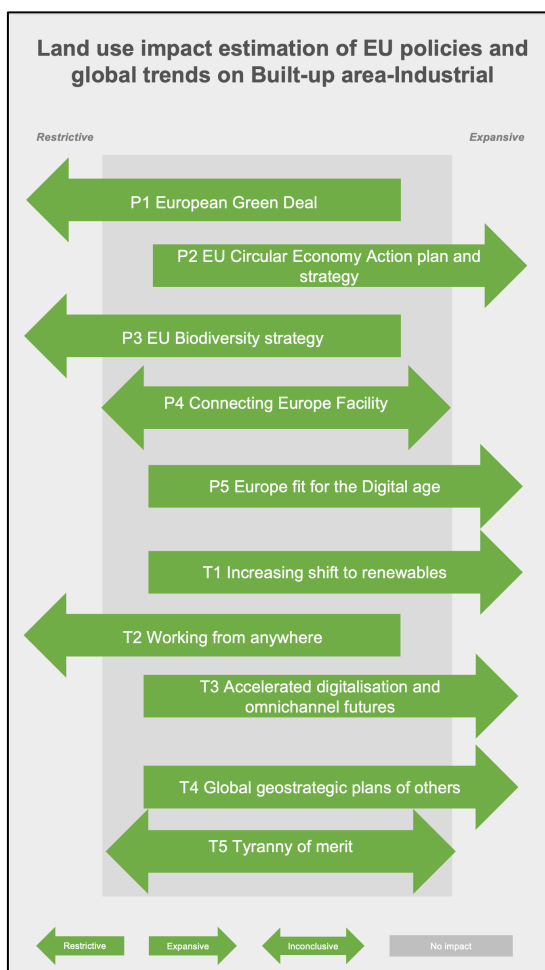


Figure 16-Land use impact estimate on Built-up area-Industrial area and offices

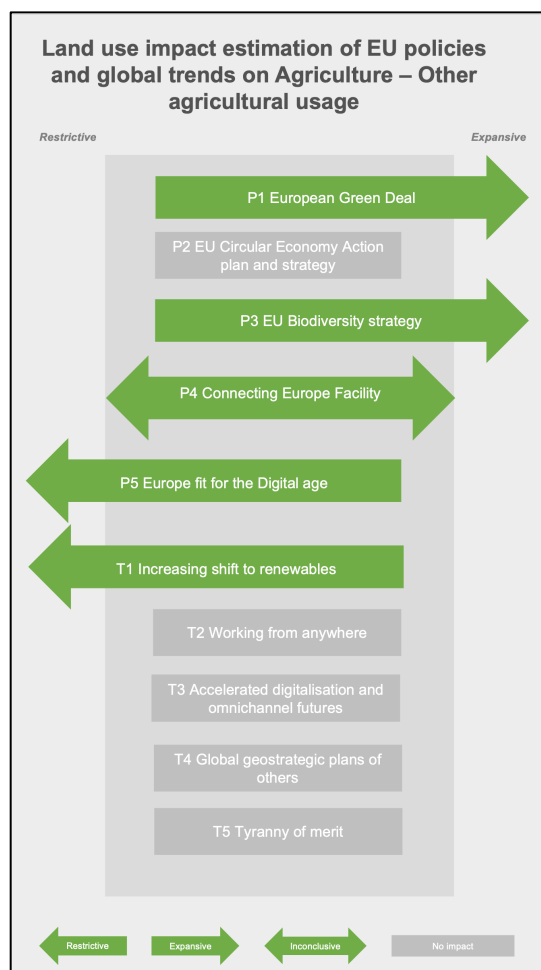


Figure 17-Land use impact estimate on Agriculture-Other

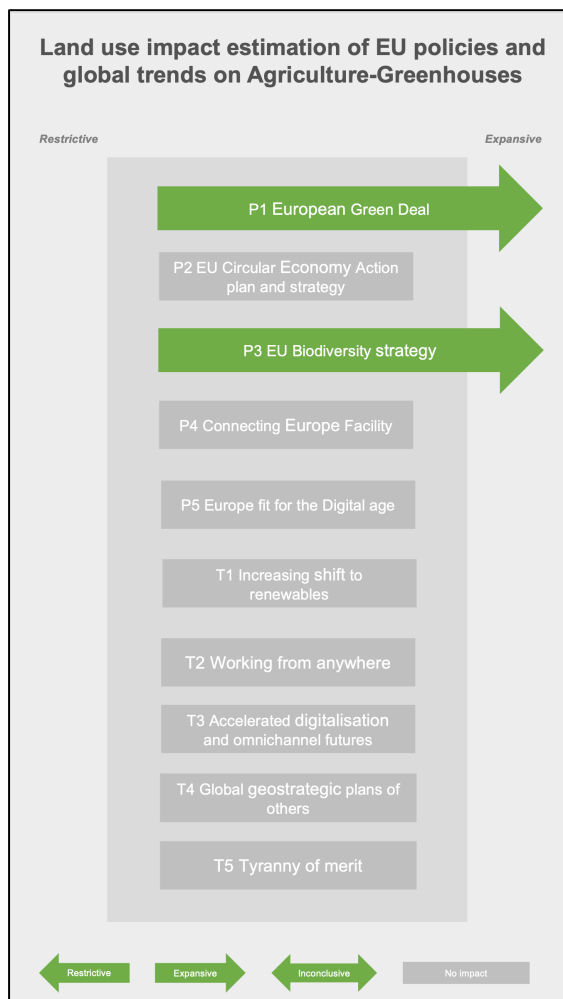


Figure 18-Land use impact estimate on Agriculture-Greenhouses

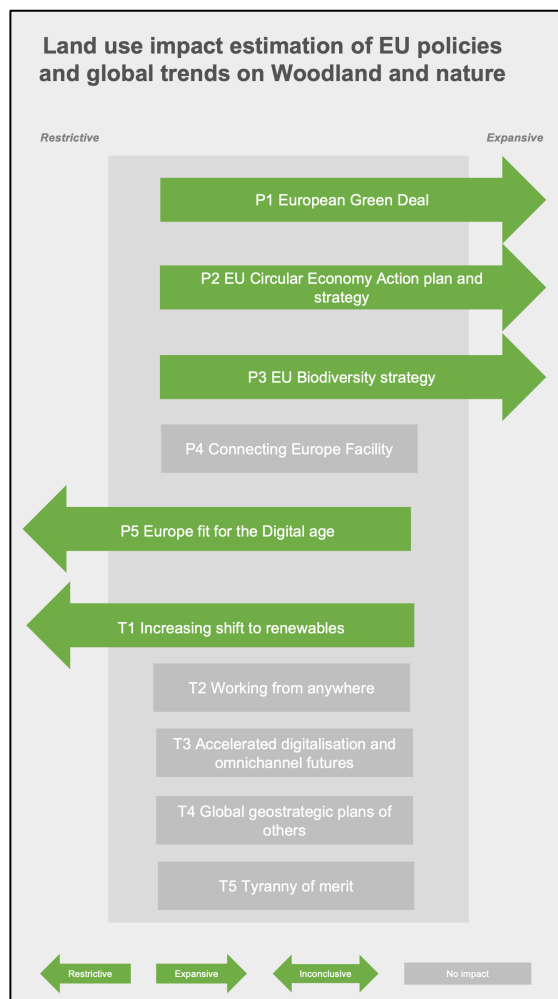


Figure 19-Land use impact estimate on Woodland and nature

Further overlapping effects of different policies and trends can be found in the case study analysis for each case.



6 Potential impact of EU policies and global trends on five case studies in the Netherlands

This chapter outlines the estimates on land use impact in the five selected case studies. The starting point for the estimates is the land use profile for each case study. Additional data points highlight potential drivers of land use change such as economy, socioeconomic characteristics, and quality of life.

6.1 Delfzijl en omgeving (COROP region)

Delfzijl en omgeving is the region encompassing the Eems delta and overlapping with the municipality of Eemsdelta in Northern Netherlands (Province of Groningen) on the coast of the Eems river and its estuary to the North Sea (Dollart Bay). A region comprising mostly of small towns, some of which with industrial harbours (e.g., Delfzijl). With a size of 36 407 ha (CBS 2015), it is a small and less populated region close to the border with Germany (Lower Saxony).

Land use profile

The region has a 62% share of Agricultural-Other land, higher than the national share in the same category. The region scores lower than national shares in all other land use categories (CBS Land use; all categories, municipalities; COROP regions, 2015).

Potential land use impact of EU policies and global trends on Delfzijl en omgeving

As a predominantly agricultural region Delfzijl en omgeving can be particularly susceptible to EU policies and trends that have effects on agricultural land. As part of the European Green Deal (policy objectives 'Improve the condition of the environment' – P1.1. and 'More sustainable food production'- P1.2.) the utilisation of the agricultural land for more organic and sustainable agriculture in the region can increase. Depending on the uptake of technology in agriculture, this potential increase can be compensated with improved efficiency. There may be potential for non-soil bound agriculture as well in case the market utilizes this opportunity. From the perspective of the ambitions of the EGD to preserve and expand agricultural land on national level, Delfzijl en omgeving can contribute to national targets, but this could create challenges on regional level due to the parallel potential expansion of industrial areas. The EU Biodiversity Strategy (Policy P3) may create further conflicts and challenges for the region due to the need for expansion of natural areas (which are currently at a rather low share). Being a coastal region, Delfzijl may be particularly challenged to facilitate this long term due to rising sea levels.

As a coastal and harbour region, Delfzijl can be prompted to further explore and expand the potential of its port infrastructure ('Smart and sustainable mobility' – P1.3.) and waterways which can contribute to the expansion of transport and industrial land use. There are already indications that the port of Delfzijl is expanding.¹³ Additional factors in this regard are the already completed projects from the TEN-T

¹³ <https://www.groningen-seaports.com/en/nieuws/groningen-seaports-closes-a-memorable-year-with-a-forecast-profit-of-17-5-million-euros/>



network (Policy P4 - CEF) and the strategic location on the river Ems, at the border with Germany and close to the North Sea. The port of Delfzijl is in a good competitive position (as part of Seaports Groningen operations on provincial level) currently, but it is difficult to estimate to what extent it can remain competitive in the hypothesis of decreased freight traffic due to lower imports of materials in the EU (Policy Circular Economy strategy – P2) or in the hypothesis if increased freight traffic due to more global online trade (Trend Accelerated digitalisation – T3). The exploitation of the gas reserves in the region can also have an influence on the port. The effects on transport and industrial land use as a result of the role of the port are uncertain as the expansion of the port is dependent on the transition to circular economy and global freight traffic as well as its overall competitiveness to other ports.

The need to find more space for renewable energy projects ('Affordable clean energy' – P1.5. and trend Shift to renewables – T1) can also represent a challenge for Delfzijl, due to its high share of agricultural land. As a region closer to the North Sea, it has beneficial conditions for the generation of wind energy. As a border region, Delfzijl may have the opportunity to cooperate with Germany on cross-border energy projects (Trend Shift to renewables – T1, Policy CEF – P4), including through offshore wind energy projects, such as the ones that are already operating in the region. In case more space on land is to be allocated for renewable energy projects, it will likely require conversion of agricultural land as this is the highest share within the region. Other alternatives can be conversion of existing industrial facilities, dual land use (e.g., agrivoltaics) or the phasing out of the gas extraction fields. The transition to renewable energy will contribute to expansion of industrial land use and will require either the adaptation of existing land of the same type or the conversion of other land to facilitate this space.

Industrial land use can also further expand as a result of the circular economy transition. Factors such as the potential increase of industrial areas to facilitate new methods of circular production ('Empowering consumers' - P2.2.) could affect the region as the lower share of industrial areas suggests a capacity to accommodate such expansion. The strong traditions and role of the chemical and heavy industry in the city of Delfzijl can potentially be an advantage for this transition. New industrial facilities, utilising waste products are already being built or are planned in the near future.¹⁴ The chemical industry cluster is also exploring options for partnership and reutilisation of waste products in the production cycle.¹⁵ This indicates that the industry in the region is already working on the transition, therefore this can potentially lead to further expansion of industrial land.

Industrial and office land use expansion due to improved competitiveness in the technological industry is less likely. The potential for competitiveness of the region is uncertain due to the unclear prospects of the port as well as due to its unfavourable position in terms of potential expansion of technological industries (Policy Europe fit for the Digital Age – P5, Trend Accelerated digitalisation – T3). Proximity to the university city Groningen could potentially be explored in this regard. In terms of critical raw materials, some production sites in the region have recently experienced decrease in production of aluminium, for instance, as a result of the increasing energy prices.¹⁶ As a coastal region, Delfzijl cannot be a critical computing capacity location, especially also due to the seismic activity in the area (Policy

¹⁴ <https://www.gasunie.nl/en/news/new-green-gas-plant-coming-to-delfzijl-the-netherlands>

¹⁵ https://www.eew-energyfromwaste.com/fileadmin/content/infomaterial/standorte_-_eng/eew_delfzijl_gb.pdf

¹⁶ <https://www.euronews.com/next/2022/09/03/power-prices-netherlands-aluminium>



Europe Fit for the Digital Age – P5). Economic growth and subsequent migration that can trigger increased demand for residential space is less likely due to the above factors. The population data indicates minor population shrinkage tendencies in the region, which may also affect land use demands. The current economic performance of the region, especially in technological industries, does not indicate potential impacts on industrial and office space as a result of economic growth in this sector.

The region has the lowest satisfaction rates with living environment and housing in the whole country (72.3% of people satisfied with the environment, while 77% satisfied with their housing, both the lowest in the country¹⁷). This implies that the region may not be very attractive for remote working migration (Trend Working from anywhere – T2), despite its lower share of residential land which suggests space for expansion of residential area. Thus, increase of this type of land use as a result of this specific type of migration is less likely. At the same time, the region's population keeps decreasing and currently is at ±46 000 people. This indicates that it can potentially be a suitable location for external migration (incl. refugee relocations) (Trend Geostrategic plans of others - T4). Potential expansion of residential land use can occur as a result of active migration management policies, specifically in the possibility of increased involuntary migration to the country.

The uncertain potential for competitiveness illustrated above, together with the low satisfaction of the living environment and the low trust in others and in institutions (36th and 39th place out of 40 in Netherlands¹⁸) suggest that the region is at risk of being left behind (Trend Tyranny of merit - T5). The purchasing power in the region is one of the lowest in the Netherlands (38th out of 40 places in 2020). The results from the latest provincial elections indicate that the citizens in the region are supportive of parties that address the interests of agricultural workers and are challenging the status quo (BBB won the elections with 29.7% in the Municipality of Eemdelta¹⁹). These results also suggest that there might be societal divisions between the rural part of the region and the industrial harbour in the city of Delfzijl. This may also be indicative of potential challenges in accommodating different interests regarding agricultural and industrial land use.

The land use in Delfzijl en omgeving will be most influenced by the need to preserve and potentially expand agricultural and natural areas on national level to facilitate the transition to more organic and sustainable agriculture and the ambitions and potential of the expansion of the chemical industry and the port infrastructure. The large share of agricultural land indicates the need to find viable solutions to balance between the economically viable agricultural production and the preservation of nature and landscape, as outlined in the current NOVI strategy (BZK 2020). The potential expansion of the port and industry, paired with the need to allocate further space for renewable energy, can prompt the conversion of agricultural land and expand industrial land. As a coastal region, the area can also be threatened by rising sea levels which can create further difficulties. Its proximity to the border with Germany could offset some of the pressure, especially for renewable energy space.

¹⁷ <https://www.cbs.nl/nl-nl/visualisaties/regionale-monitor-brede-welvaart/thema>

¹⁸ <https://www.cbs.nl/nl-nl/visualisaties/regionale-monitor-brede-welvaart/thema>

¹⁹ <https://nos.nl/collectie/13923/artikel/2467604-bekijk-hier-alle-uitslagen-van-de-provinciale-statenverkiezingen>



Table 1 presents a summarised version of the potential land use impact on Delfzijl en omgeving. The transport (incl. waterways) land use in the region is expected to expand as a result of the efforts to expand water transportation (supported by EGD – P1). Expansion of residential land use can be driven by active migration policies (trend Global geostrategic plans – T4). Residential use expansion due to economic growth or attractiveness is less likely. Industrial areas can expand as a result of the role of the port as well as to facilitate new circular production practices (Circular economy strategy – P2, trend Accelerated digitalisation – T3), including for the established chemical industry. Port expansion will depend on global economic flows and the competitiveness of the port to other North Sea harbours. The vast shares of agricultural land will need to accommodate more sustainable and organic agricultural practices (EGD – P1 and Biodiversity strategy – P2). As the largest share of land use agricultural land is at risk of conversion to facilitate potential industrial expansion. The low shares of natural land can be expanded (Biodiversity strategy – P2) but this can be challenging due to the coastal location and potential expansion of industrial zones.



Delfzijl en omgeving							
Land use category	Transport (no water)	Inland water	Residential	Industrial	Greenhouses	Other agricultural usage	Woodland and nature
Policy-Trend/% of total surface as compared to nat.share	2,09%	1,30%	2,97%	1,36%	0,00%	61,73%	2,36%
P1 European Green Deal	Expansive		Inconclusive	Restrictive	Expansive	Expansive	Expansive
P2 EU Circular Economy Action Plan and Strategy	Restrictive		No impact	Expansive	No impact	No impact	Expansive
P3 EU Biodiversity Strategy	No impact		Restrictive	Restrictive	Expansive	Expansive	Expansive
P4 Connecting Europe Facility	Expansive		Expansive	Inconclusive	No impact	Inconclusive	No impact
P5 Europe Fit for the Digital Age	No impact		Expansive	Expansive	No impact	Restrictive	Restrictive
T1 Increasing shift to renewables	No impact		Expansive	Expansive	No impact	Restrictive	Restrictive
T2 Working from anywhere	Inconclusive		Expansive	Restrictive	No impact	No impact	No impact
T3 Accelerated digitalization and omnichannel futures	Restrictive		Expansive	Expansive	No impact	No impact	No impact
T4 Global geostrategic plans of others	No impact		Expansive	Expansive	No impact	No impact	No impact
T5 Tyranny of merit	No impact		Expansive	Inconclusive	No impact	No impact	No impact
Potential land use impact specific to the region	Potential expansion of waterways, although pending projects in CEF are completed.		Low population size, has capacity to grow. Expansion more likely in case of targeted migration management policy. Expansion due to remote working less likely due to low scores in liveability.	Potential expansion of port (depends on global trade flows) and industry to facilitate new circular production, incl. for chemical industry. Potential expansion to facilitate renewable energy sources.	Vast shares of agricultural land will need to accommodate transition to organic and sustainable agriculture. Can be threatened by conversion due to industrial land expansion, including renewable energy.		Low natural land use. Potential expansion of those areas can be challenging due to potential expansion of industrial land use and rising sea level risks.

Table 1 – Summary of potential land use impact of EU policies and global trends on Delfzijl en omgeving. The land use percentage measurements on row 2 in the table show the share of the specific type of land use in the respective case study. The percentage is calculated by dividing the area of each specific land use type in hectares by the total area of the region or city in hectares and thus results in the share of this type of land in the specific case. The colour-coding indicates if the calculated share is lower or higher than the share of the same land use type on national level.



6.2 Achterhoek (COROP region)

De Achterhoek is a predominantly rural region in Eastern Netherlands (Province of Gelderland) close to the border with Germany (North-Rhine Westphalia) with the highest agricultural land use share as compared to all other COROP regions. The region does not have a major urban centre. Some population shrinkage challenges have been experienced over time. With its area of 156 108 ha (CBS 2015) it is a medium size region in the country.

Land use profile

The region has a very high share of Agriculture-Other land, scoring 76% in this category which is 23% higher than the national share of this type of land. The region scores lower than national shares in all other land use categories (CBS Land use; all categories, municipalities; COROP regions, 2015).

Potential land use impact of EU policies and global trends on Achterhoek

With the highest share of agricultural land from all COROP regions in the Netherlands, De Achterhoek can be particularly influenced by land use changes that pertain to agriculture. With its comparative to national share of natural areas, this type of land can also be affected by the ambitions for expansion in order to facilitate the transition to organic and sustainable agriculture. The adoption of technological solutions in agriculture can potentially offset the further need for its expansion.²⁰ Established traditions in the agricultural sector can also lead the innovations, more organic farming, or potentially also non-soil-based farming. As an established agricultural region, it can potentially benefit from the implementation of AI in agriculture and increase yields from the available land (policy objective 'AI in agriculture' - P5.3.) and thus utilise the agricultural land more efficiently. From the perspective of the European Green Deal (Policy P1), further demands for expansion of those two types of land can put pressure on it in the region. From a national perspective, the region can contribute to national targets with the higher share of agricultural areas and the significant share of protected natural areas as part of Gelders Natuurnetwerk.²¹

Expansion of transport land use as a result of new projects in CEF (P3) or expansion of waterways is not expected. De Achterhoek is effectively cut off from the TEN-T network, despite being close to major corridors such as Rhine-Alpine and North Sea-Baltic, therefore no expansion of the transport infrastructure is expected. This can contribute negatively to its competitiveness. Its proximity to the Ruhr region in Germany may have minor effects on traffic increase, but no effects on transport land use (Policy P4 - CEF).

²⁰ This estimate may be less relevant for the Dutch context due to the advanced agricultural practices already established in the Netherlands. As a leader in agriculture, the Netherlands is at the forefront of intensification of agricultural production, also specifically in De Achterhoek where $\pm 20\%$ of the companies are operating in the food and agricultural sector and generate $\pm 18\%$ of the employment in the region, according to a study by Altera Institute at Wageningen University (Fontein et al. 2013)

²¹ <https://www.atlasleefomgeving.nl/kaarten?config=3ef897de-127f-471a-959b-93b7597de188&qm-x=150000&qm-y=455000&qm-z=3&qm-b=1544180834512,true,1;1553765981928,true,0.8;&activateOnStart=layermanager.info&activeTools=layercollection,search.info,bookmark,measure,draw,koeltorens>



Expansion of industrial land can be triggered by the need to allocate space for renewable energy (Policy EGD – P1, Policy CEF – P4). Potential challenges may arise between these needs and the vast natural and agricultural land. The space for renewable energy may require conversion of agricultural land unless solutions such as dual land use are explored. As a border region, De Achterhoek can potentially offset this with cross-border cooperation with Germany. As the region is predominantly rural and does not have major cities, conflicts between urban sprawl and agricultural and natural areas are not anticipated.

Industrial and office land use expansion as a result of economic growth is less likely, although there is some potential in this regard. De Achterhoek could potentially accommodate expansion of industrial areas due to its low share of this type of land. This expansion could occur as a result of increased need for recycling facilities to support the transition to circular economy (policy objective 'Reduce waste' – P2.4.). Its proximity to the border with Germany may open possibilities for further cross-border economic cooperation. At the same time, the region is not connected to main transport corridors and being rural and less industrialised suggests minor potential for further expansion of industrial competitive economy. Due to the rural and agricultural economic profile of the region and the lack of university centre or established clusters in the technological industry, growth in the area of technological industry is less likely (Policy Europe Fit for the Digital age – P5 and trend Accelerated digitalisation – T3). Potential expansion of industrial land as a result of economic growth can increase the need for land conversion, most likely for agricultural land.

Residential land use can expand as a result of migration, triggered by the attractiveness of the region due to its high quality of life scores. The region has a high score on satisfaction with housing and living environment (5th place in the Netherlands with 90% satisfied with housing²²). This score indicates an overall good quality of life which may make the region attractive for remote workers (Trend Working from anywhere – T2) in light of its lower share of residential land, which may trigger an increase of this type of land use. The housing sector, however, is already under pressure.²³ Its proximity to major economic regions, such as the Ruhr in Germany, can potentially contribute to this trend in the context of increasing cross-border cooperation.²⁴ With low population (±400 000) and low population density (269 persons per square km. in 2022 as compared to 420 in Gelderland and 512 on national level²⁵) the region has capacity to accommodate more population in potential increase of migratory pressure to the country (trend Geostrategic plans of others - T4), but this might increase the pressure on residential land use, despite its lower share currently. The high quality of life and proximity to major economic areas across the border can make the region attractive to migration and potentially lead to expansion of residential areas.

Further factors that can contribute to its attractiveness are the more peripheral location from the rest of the country, the rural and agricultural profile of its economy and the high liveability scores. They indicate that the region has a distinctive character, formed by these characteristics. The recent provincial elections indicate a significant majority of the BBB party in all municipalities in the region, addressing

²² <https://www.cbs.nl/nl-nl/visualisaties/regionale-monitor-brede-welvaart/thema>

²³ <https://8rhk.nl/achterhoek-stabiele-economie-met-urgente-opgaven/>

²⁴ <https://8rhk.nl/achterhoek-en-twente-samen-met-duitsland/>

²⁵ Eurostat dataset Population density by NUTS 3 region (DEMO_R_D3DENS):
https://ec.europa.eu/eurostat/databrowser/view/DEMO_R_D3DENS/default/table?lang=en



the challenges of the environmental transition to agriculture. These observations suggest that the region has a high level of social cohesion (the region ranks 5th in social contacts with family and friends and 1st in levels of volunteering²⁶).

The land use in De Achterhoek will be most influenced by the need to preserve and potentially expand agricultural and natural areas on national level to facilitate the green transition. With significant shares of this type of land, the region can contribute to the achievement of national objectives in-line with the green transition. Challenges in preserving these land use type may emerge from the need to allocate space for renewable energy. As a cross-border region, De Achterhoek can potentially offset this with closer cooperation with Germany. Its low population size and density, as well as high scores in liveability, suggest that the region has potential to grow and may be attractive for migration, thereby potentially increasing residential land use. The land use approach in De Achterhoek can be viewed in the context of restructuring of rural areas and balancing living environment considerations, agriculture economic viability and preservation of the environment, as outlined in the current NOVI strategy (BZK 2020).

Table 2 presents a summarised version of the potential land use impact on De Achterhoek. No effects are anticipated for transport land use. Residential areas can expand as a result of increased migration to the region, due to the high quality of life (trend Working from anywhere – T2). Some expansion of industrial land can be expected to facilitate space for renewable energy (EGD – P1, trend Shift to renewables – T1). Some expansion of industrial land can also be triggered by new industrial facilities for the transition to circular economy. Vast shares of agricultural and natural land can contribute to national targets for the green transition but can be threatened with conversion due to industrial land expansion.

²⁶ <https://www.cbs.nl/nl-nl/visualisaties/regionale-monitor-brede-welvaart/thema>



De Achterhoek							
Land use category	Transport (no water)	Inland water	Residential	Industrial	Greenhouses	Other agricultural usage	Woodland and nature
Policy-Trend/% of total surface as compared to nat.share	2,74%	1,05%	4,30%	1,44%	0,02%	76,04%	11,22%
P1 European Green Deal	Expansive		Inconclusive	Restrictive	Expansive	Expansive	Expansive
P2 EU Circular Economy Action Plan and Strategy	Restrictive		No impact	Expansive	No impact	No impact	Expansive
P3 EU Biodiversity Strategy	No impact		Restrictive	Restrictive	Expansive	Expansive	Expansive
P4 Connecting Europe Facility	Expansive		Expansive	Inconclusive	No impact	Inconclusive	No impact
P5 Europe Fit for the Digital Age	No impact		Expansive	Expansive	No impact	Restrictive	Restrictive
T1 Increasing shift to renewables	No impact		Expansive	Expansive	No impact	Restrictive	Restrictive
T2 Working from anywhere	Inconclusive		Expansive	Restrictive	No impact	No impact	No impact
T3 Accelerated digitalization and omnichannel futures	Restrictive		Expansive	Expansive	No impact	No impact	No impact
T4 Global geostrategic plans of others (outside of Europe)	No impact		Expansive	Expansive	No impact	No impact	No impact
T5 Tyranny of merit	No impact		Expansive	Inconclusive	No impact	No impact	No impact
Potential land use impact specific to the region	No effects on transport land use anticipated.		Potential expansion due to attractiveness thanks to good quality of life. Can be attractive for migration or remote working.	Potential expansion to facilitate renewable energy sources. Some potential for expansion for new industrial facilities (e.g., recycling) for circular economy.	Vast shares of agricultural land will need to accommodate transition to organic and sustainable agriculture. Can be threatened by conversion due to industrial land expansion, including renewable energy.		Potential to contribute to national targets for natural land and protected areas.

Table 2 - Summary of potential land use impact of EU policies and global trends on De Achterhoek. The land use percentage measurements on row 2 in the table show the share of the specific type of land use in the respective case study. The percentage is calculated by dividing the area of each specific land use type in hectares by the total area of the region or city in hectares and thus results in the share of this type of land in the specific case. The colour-coding indicates if the calculated share is lower or higher than the share of the same land use type on national level.



6.3 Rijnmond (COROP sub-region)-Rotterdam Metropolitan Area

A densely populated area with a rather small size of 73 950 ha (CBS 2015) surrounding Rotterdam and its metropolitan area. The COROP sub-region overlaps with the Rotterdam urban region (Stadsregio Rotterdam), including the Rotterdam port area in the western part of the Netherlands on the coast of the North Sea. The region encompasses the municipalities of Albrandswaard, Barendrecht, Brielle, Capelle aan den IJssel, Hellevoetsluis, Krimpen aan den IJssel, Lansingerland, Maassluis, Nissewaard, Ridderkerk, Rotterdam, Schiedam, Vlaardingen, Westvoorne in the province of Zuid-Holland. The region also includes large parts of the Rhine-Meuse-Scheldt delta and is home to more than 1.2 million people, making it a densely populated region.

Land use profile

The region has a significantly higher share of transport land use (8.78%) as compared to the national share of 2.78%. Its residential area accounts for 16% of the total area which is significantly higher than the national share. The same applies to the 17.70% of the industrial and office land use which is 15% higher than the national share and almost as high as the Eindhoven urban core share in the same category. Agricultural and natural areas are lower than average. A significant share of the land use is for inland water (17.79%) due to its geographical positioning close to the delta. (Copernicus Urban Atlas 2018 dataset, LAU boundaries of municipalities part of the sub-region).

Potential land use impact of EU policies and global trends on Rijnmond

A densely populated urban metropolitan region with Rotterdam at its core, Rijnmond is more susceptible to potential effects of policies and trends on industrial and residential land use. The region already has very high shares of those two land use types and the potential impact of policies and trends indicate that they may need to expand further to facilitate its further economic and population growth.

With its very low share of natural land, the region can hardly contribute to ambitions for carbon offsetting from the European Green Deal (Policy P1). In fact, Rijnmond may be under significant pressure not to expand further (or do so vertically rather than horizontally) due to the ambitions of EGD to limit urban sprawl. The region is in a challenging position in regard to the objectives of the EGD as they intend to limit sprawl (policy objective 'Improve the condition of the environment') while at the same time increase the industrial land use for fishing and for more environmentally friendly transport such as waterways and land transportation (policy objective 'More sustainable food production' – P1.2. and policy objective 'Smart and sustainable mobility' - P1.3.). As a coastal location and a key transport node in the Randstad (and beyond), these land use types can further expand. The region has lower share of agricultural land and minor share of greenhouse land. These areas will still need to accommodate transition to organic and sustainable agriculture.

Rijnmond has a very high share of both industrial and transport land use which may create a challenge or may have to trigger planning decisions that go beyond the limits of the region in order to offset its potential share on national level. From regional perspective, the further potential expansion of industrial areas can jeopardise the achievement of the objectives pertaining to the preservation of the environment



and natural areas, especially the ones bordering the region. However, on national level, expansion of industry in this region can be offset by expansion of nearby natural areas so as to compensate emissions and pollution. This also applies to the desired effects of the Biodiversity strategy (policy P3) which aims to expand natural areas. On urban level this can lead to increase allocation of natural space by expanding green areas. On regional level, the preservation and potential expansion of natural areas can create conflicts with neighbouring areas, such as protected areas south of Rotterdam.

Further expansion of transport land use can be expected due to the strategic location of the region. It is already very well connected to the rest of the country and Europe, including through land, railway, and water transportation. The further improvement of transport connectivity, envisioned in the EGD (P1), for instance, can stimulate commuting even more and thus feed into urban sprawl. Although all TEN-T projects in the area have been completed, the strategic location of Rijnmond and Rotterdam can put further pressure on expansion of the existing transport infrastructure. The potential expansion in this regard can be also focused on the option to increase the key European transport infrastructure capacity as part of the Rhine-Alpine and North Sea-Baltic corridors. The already high share of transport land use is expected to expand further.

The region will also be affected by the need to allocate space for renewable energy as part of the green transition (EGD – P1, trend Shift to renewables – T1). Its proximity to the North Sea suggests that more space can be necessary for renewable energy generation, such as wind energy. As a highly urbanised region, Rijnmond can potentially accommodate smaller projects, utilising existing space within the built environment. Beyond those small projects, industrial land will need to be expanded even further to accommodate larger-scale renewable energy infrastructure.

Industrial and office space can further expand as a result of economic growth. The demand for industrial land use can be additionally amplified by the need to construct new industrial facilities for recycling and circular production (policy objective ‘Circular value chains’ - P2.3.) or potential increase of investment and employment in key industries (e.g., technology) which may subsequently fuel further population increase of the city (policy Europe Fit for the Digital Age – P5, trend Accelerated digitalisation – T3). As a major urban centre, Rotterdam is already home to large national and international companies such as Louis Dreyfus Company, LyondellBasel Chemicals, Unilever and KPN. Rotterdam is also home to the Erasmus University Medical Centre and the National Institute for Health Sciences, indicating strong traditions in healthcare. This can contribute to the further growth of health-tech and health innovation sectors and subsequent increased need for industrial and office space. With the port of Rotterdam as the biggest port in Europe and as a strategic location, the region is expected to be under further pressure to retain and even expand the port and respectively increase industrial land use. This can be further fuelled by increases of global online trade and cargo (trend Accelerated digitalisation – T3) and the port’s strategic importance globally (trend Geostrategic plans of others – T4). Potential decrease of imports to Europe (in the context of policy objective ‘Sustainable products’ – P2.1.) may offset pressure of the port and industrial and transport land use, respectively, but this is less likely. Overall, the higher competitiveness of Rotterdam and the importance of the port, on European and global level, can be main drivers for further expansion of industrial and office space, thereby further expanding their already high shares.



The anticipated further economic growth in multiple sectors in Rotterdam and the region can attract external migration at the expense of less developed regions. This can increase the demand for residential land use. Due to the higher density, however, the cities in the region may be required to further densify through increased height of the built environment. Multifunctional land use approaches and urban regeneration of underutilised lots can also be explored. Rotterdam has a strong tradition in urban regeneration, so this can contribute to identifying more efficient spatial distribution within the city. The pressure on densification and residential land can potentially be offset by the effects of remote working (Trend Working from anywhere – T2), however, this can further fuel sprawl and pressure on surrounding regions in terms of residential land use.

The good economic prospects and the attractiveness of the region can lead to further migration pressure from within the country and internationally. The continuing increase on the demand for housing and services can create challenges for quality of life. Different population groups with different socioeconomic status and needs can choose the city as their home. These conflicting residential land use dynamics can lead to further pressure on the housing market, gentrification in the city and social divisions within the region and beyond (including internationally). The increased inequality can lead to dissatisfaction and further division in the region as well as concentration of certain socioeconomic groups in more affordable or preferred areas (Trend Tyranny of merit – T5). Challenges with quality of life and safety can already be observed in the area. The municipality of Rotterdam, for instance, scores low in overall wellbeing indicators such as satisfaction with life, housing and living conditions. In addition, it scores low in terms of trust in others and has low scores in terms of safety.²⁷ These indicators suggest that social divisions and pressure within the region already exist, and they can have influence on the land use, especially for residential land.

The land use in Rijnmond and Rotterdam will be most influenced by the further economic growth of the region, driven by its established role in the Dutch, European and global economies. A specific factor in this regard is the importance of the port of Rotterdam which is expected to retain its global importance and significance and potentially expand. These factors will lead to further expansion of industrial, office areas and transport land use. The ambitions to achieve the energy transition may prompt increased demand for renewable energy space in the region, especially due to its proximity to the North Sea. The further economic growth will contribute to the attractiveness of the city and could increase migration. This could lead to further pressure on residential land. Due to its coastal location and overall high density, the region can experience further densification challenges. This can prompt the further expansion of the metropolitan area to offset the pressure on the central urban core. This potential sprawl could lead to challenges with neighbouring natural and protected areas. In light of those findings, the land use approach to Rotterdam and its metropolitan area would be in-line with the challenges for urban areas in the Netherlands and the ambitions of the current NOVI strategy (BZK 2020) – to find viable solutions for the housing demand, to ensure integrated urbanisation within existing urban areas and to preserve and expand green areas within cities and between them.

Table 3 presents a summarised version of the potential land use impact on Rijnmond. Transport land use is expected to grow further due to the strategic position of the region in national, European, and

²⁷ <https://www.cbs.nl/nl-nl/visualisaties/regionale-monitor-brede-welvaart/thema>



international transport networks. Residential land is also expected to grow due to increased attractiveness for migration thanks to better economic prospects. This expansion can create social challenges and divisions. Industrial and office areas are expected to grow further thanks to the potential expansion of the port, due to its strategic importance, as well as due to economic growth in key industries. As a coastal location, Rijnmond will also need to allocate space for renewable energy sources which can further increase industrial land use demand. The small share of agricultural and natural land will have minor contribution to achieving national targets in the green transition. There is potential for increase of green space in the urban areas. Nearby agricultural and natural lands are under higher risk due to the anticipated further growth of the region.



Rijnmond-Rotterdam Metropolitan Area							
Land use category	Transport (no water)	Inland water	Residential	Industrial	Greenhouses	Other agricultural usage	Woodland and nature
Policy-Trend/% of total surface as compared to nat. share	8,78%	17,79%	16,00%	17,70%		23,56%	5,07%
P1 European Green Deal	Expansive		Inconclusive	Restrictive	Expansive	Expansive	Expansive
P2 EU Circular Economy Action Plan and Strategy	Restrictive		No impact	Expansive	No impact	No impact	Expansive
P3 EU Biodiversity Strategy	No impact		Restrictive	Restrictive	Expansive	Expansive	Expansive
P4 Connecting Europe Facility	Expansive		Expansive	Inconclusive	No impact	Inconclusive	No impact
P5 Europe Fit for the Digital Age	No impact		Expansive	Expansive	No impact	Restrictive	Restrictive
T1 Increasing shift to renewables	No impact		Expansive	Expansive	No impact	Restrictive	Restrictive
T2 Working from anywhere	Inconclusive		Expansive	Restrictive	No impact	No impact	No impact
T3 Accelerated digitalization and omnichannel futures	Restrictive		Expansive	Expansive	No impact	No impact	No impact
T4 Global geostrategic plans of others (outside of Europe)	No impact		Expansive	Expansive	No impact	No impact	No impact
T5 Tyranny of merit	No impact		Expansive	Inconclusive	No impact	No impact	No impact
Potential land use impact specific to the region	Further expansion of transport infrastructure (land, railway, and waterways) due to its strategic location nationally and globally.		Expected further expansion of residential areas because of increased migration thanks to expected economic growth. Densification issues. Risk of social divisions in residential space based on current liveability scores.	Expected further increase of port area due to its strategic location. Expected expansion due to economic growth in key industries. Expected expansion to accommodate renewable energy sources. Densification issues.	Smaller agricultural share will still need to accommodate transition to organic and sustainable agriculture, including in limited amount of greenhouse areas. Bordering agricultural areas can be threatened by the growth of the metropolitan area.		Minor shares of natural land, potential expansion of green space in urban areas. Nearby natural areas can be threatened by the growth of the metropolitan area.

Table 3 - Summary of potential land use impact of EU policies and global trends on Rijnmond – Rotterdam Metropolitan Area (Sub-COROP region Rijnmond). The land use percentage measurements on row 2 in the table show the share of the specific type of land use in the respective case study. The percentage is calculated by dividing the area of each specific land use type in hectares by the total area of the region or city in hectares and thus results in the share of this type of land in the specific case. The colour-coding indicates if the calculated share is lower or higher than the share of the same land use type on national level.



6.4 Zuidoost-Noord-Brabant (COROP region). Eindhoven.

Zuidoost-Noord-Brabant is a densely populated region (more than 700 000 people) in the south(-west) of the Netherlands with key urban centres Eindhoven, Helmond and Veldhoven. A strongly industrial and educational region with the designation Brainport, encompassing the close cooperation between all municipalities to develop the industrial strength of the area. Bordering Belgium (Flanders), the region is at a strategic location close to main port areas such as Rotterdam and Antwerp. The region is of medium size with 145 766 ha (CBS 2015) and is located in the province of Noord-Brabant.

Land use profile – Regional level

The region has a moderately high total surface which is predominantly covered by agricultural land (Agriculture-Other) and natural areas (a significant 13% higher than the national share). The residential area, industrial and office area and the transport land use are also higher than the national shares (CBS Land use; all categories, municipalities; COROP regions, 2015).

A closer look at the main urban centre Eindhoven reveals a stark contrast to the shares of land use as compared to the region. This is indicative of the concentration of population and industrial activity within the city boundaries.

Land use profile – Eindhoven

The share of transport land use is 16.75% (13% higher than the share on regional level), the share of residential area is 28.21% (20% higher than the share on regional level), the share of industrial and office areas is 19.50% ($\pm 17\%$ higher than the share on regional level). These differences indicate a disproportionate concentration of population, economic activity, and transport infrastructure in the urban core of Eindhoven, as well as issues of densification (Copernicus Urban Atlas 2018 dataset, Eindhoven urban boundary).

Potential land use impact of EU policies and global trends on Zuidoost-Noord-Brabant and Eindhoven

A densely populated region in the province of Noord-Brabant, Zuidoost-Noord-Brabant is a major economic area with more than 700 000 inhabitants and has the fourth highest GDP at current market prices (EUROSTAT 2020)²⁸ in the Netherlands. The COROP region overlaps with the Eindhoven metropolitan area and its designation Brainport, highlighting the strong economic performance of the region. The region has a $\pm 26\%$ share of natural areas ($\pm 13\%$ more than the national share) as it is also home to two large natural areas – the Peel (De Peel) and the Campine (Kempen), parts of which are protected. Against this background, the profile of the region, especially considering Eindhoven as a main urban and economic centre, indicates a challenge in accommodating the conflicting needs of further expansion of economic activity and the expansion and preservation of agricultural and natural areas

²⁸ EUROSTAT Gross domestic product (GDP) at current market prices by NUTS 3 regions NAMA_10R_3GDP: https://ec.europa.eu/eurostat/databrowser/view/nama_10r_3gdp/default/table?lang=en



regionally. This conflict can also be observed in the estimates for the potential effects on land use on regional level (Zuidoost-Noord-Brabant) and on urban level in Eindhoven.

In the context of the European Green Deal, the vast amount of natural and agricultural land in the region can be an important part of the national efforts to offset carbon pollution. Their potential expansion to facilitate the transition to organic and more sustainable agriculture and the biodiversity ambitions can be challenging considering the anticipated expansion of industrial and residential areas thanks to the expected economic and population growth. Due to the proximity of natural and agricultural areas to urban centres, agricultural and natural land can be threatened by conversion in case the urban areas expand further.

Expansion of industrial and transport land use can be fuelled by multiple factors. These two land use shares are already higher than the national share in both Eindhoven and the region. The ambitions to expand sustainable transport infrastructure (policy objective 'Smart and sustainable mobility' - P1.3.) can trigger further expansion of transport land use. At the same time, transport can fuel suburbanisation, which can jeopardise the vast natural areas on regional level and the agricultural land. The lower share of inland water and its potential expansion as a waterway (as part of policy objective 'Smart and sustainable mobility' - P1.3.) may further complicate this balance. The expected decrease in transport demand as part of more circular value chains (policy EU Circular Economy strategy – P2) can potentially offset the pressure of transport land use on regional and urban level. However, the shares of this land use type are high enough in both the region and the city, therefore this effect can be limited. All projects from the TEN-T network (policy CEF - P4) have been completed in the region, despite not being part of any of the European corridors. The region is overall well connected to those. The disproportionate concentration of industrial activity in the city of Eindhoven can put further pressure on the usage of transport land and potentially lead to discussions for further expansion. As a technological centre, the region is well positioned to play a key role in the TEN-Telecom network (policy objective 'TEN-Telecom' – P4.3.). New industrial zones in more compact forms or closer industrial clusters can potentially balance the need for expansion of transport infrastructure.

Further pressure for land conversion to industrial areas may come from the need to increase space for renewable energy (policy objectives 'Double energy renovation rate'- P1.4. and 'Affordable clean energy' - P1.4, trend Shift to renewables – T1 and CEF related energy projects under policy objective 'TEN-E' - P4.2.). On regional level, this may require the conversion of agricultural land to industrial (unless solutions such as dual land use are applied) whereas within the city of Eindhoven this can be offset by using smaller scale projects as part of the existing built environment (e.g., rooftops).

Further expansion of industrial and office land use could occur as a result of economic growth in key industries and as part of the transition to circular economy. The further expansion of industrial areas to accommodate new industrial facilities for circular production (policy objective 'Circular value chains' - P2.3.) can create a disproportionate pressure on Eindhoven. New industrial zones with increased proximity and compact forms can potentially compensate this. At the same time, on regional level there appears to be some room for expansion of industrial areas.



Further expansion of industrial and office space could be fuelled by the strategic importance of Eindhoven and the region to the priorities of the policy Europe fit for the Digital Age (P5). This policy is perhaps the most relevant for the region as a technological centre and can be the main factor fuelling its economic growth. The policy is looking to double the current share of production of semiconductors (policy objective 'EU semiconductor leader' – P5.1.). This directly concerns the cities of Eindhoven and Veldhoven and the semiconductor industry as some of the largest players in the field are located there – ASML, NXP. The region is effectively a strategic location for the EU regarding the digital economy and competitiveness as an already established centre. The ambitions of the EU in that sense, concern the region directly and turn it also in a globally relevant strategic node in the context of potential collaboration with the US (policy objective 'EU strategic autonomy and the US – P5.5.) and the global race in the digital space (trend element 'US and China tech supremacy' - T.4.1.). For the same reason, the region can be affected by global shifts in the technological industry, especially if those result in decreasing the role of Europe in this field. Even in this hypothesis, the region is well established, and its importance is not expected to fade, especially in the context of ever-increasing digitalisation (trend Accelerated digitalisation - T3). The technological industry in Eindhoven can be a main contributor to advancements in the areas of ed-tech and health-tech (e.g., Medtronic has an office in the city and the global Phillips Innovation hub on health-tech is also located there²⁹). Further potential for growth can be generated through partnerships with TU Eindhoven and in the broader industrial ecosystem of the Brainport. As an inland region, Zuidoost-Noord-Brabant is also a possible location for critical computing capacity in the EU, especially considering its strong technical profile. This potential economic growth can fuel the expansion of industrial areas in urban centres, including Eindhoven, and on regional level. Any potential expansion of industrial zones in the region will need to balance between the further concentration of those areas in the city of Eindhoven and their potential expansion on regional level, at the expense of agricultural and natural areas. The vast scale of protected areas in the region, although benefiting quality of life, green infrastructure, and recreation, may create significant challenges for regional planning as there would be an immediate conflict between the need to preserve and potentially expand natural areas (e.g., policy EGD – P1, policy EU Biodiversity strategy – P3) and the need to expand industrial areas to offset the pressure on Eindhoven.

Further pressure on residential land use could also be expected as a result of the anticipated economic growth. As a key location for the technological industry and a main urban centre, Eindhoven can continue attracting migration from within the Netherlands and beyond and thus put further pressure also on residential land use (which is already very high as compared to national shares). The residential land use share is also high on regional level, thus balancing further growth and the vast amounts of agricultural and natural areas in the whole region will become the main planning challenge in the long term. Possible compensating effects on residential land demand can be generated by remote working (trend Working from anywhere - T2), however, since the region is mostly focusing on industrial production, these potential effects will be limited. Possible further cross-border collaboration with Belgium can balance the pressure on residential land use – such trends are already observed as there is a high number of cross-border workers in the region, coming from Belgium.³⁰ In case migration waves to the Netherlands increase (trend T4 – Geostrategic plans of others), Eindhoven can be under further

²⁹ <https://www.philips.com/a-w/about/innovation/innovation-hubs/eindhoven.html>

³⁰ <https://www.cbs.nl/en-gb/news/2020/46/inbound-commuters-often-live-just-across-the-border>



pressure to provide services (the region scores high in service accessibility – e.g. sport infrastructure, schools³¹) and residential space as a location that can attract both forcefully displaced people and expat professionals. This pressure can come on top of the existing attraction potential of the whole region, including being a university centre with the TU Eindhoven positioned there. Zuidoost-Noord-Brabant has the 10th highest share of population with higher education in the Netherlands. These potential overlapping effects of migration can come on top of already high migration scores in the region – more than 60/1000 are the total arrivals in the region for the last 2 years and an average total growth of population of more than 4 000 people on annual basis (CBS³²).

Overall, the potential land use impact of the different policies and trends will create challenges for regional planning in the area, mostly revolving on the balance between the natural and agricultural areas and the desire to further improve the competitiveness of the region and support its growth. The competing ambitions between its technological competitiveness and solid position in agricultural production can result in challenging planning decisions in terms of land use. Also, the good balance on regional level between natural and built areas contributes to quality of life. This can create conflicts also on social level as different groups may be in favour of either of the developments. Such division can be observed in the recent results from the provincial elections where the agricultural party BBB has obtained majority in most of the smaller municipalities in the region, but the urban core in Eindhoven and its surrounding towns established parties such as the Greens and VVD have won majority. These divisions can contribute to exacerbated social cohesion and disproportionally affect different social groups (trend T5 – Tyranny of merit), especially in light of the over-emphasis on tech-related jobs. This can create further separations between well-paid high-skilled professionals and less qualified workers, including on territorial level. In the province of Noord-Brabant $\pm 13,5\%$ of the population is at risk of poverty or social exclusion – a score that has remained without improvement for the last few years (EUROSTAT³³). It is likely that such divisions will occur between the city and the rest of the region as Eindhoven is clearly pursuing further growth³⁴ while being spatially limited by the surrounding natural and agricultural areas. The recent agenda of the Brainport from 2021³⁵ indicates that considerations for these challenges are taken into account. At the same time, the findings from this analysis indicate that it can be challenging to accommodate further growth in the city of Eindhoven without threatening the nearby natural and agricultural areas, despite their contribution to economy and quality of life. Therefore, a more balanced approach and distribution of land on regional level can potentially offset this pressure. Multifunctional urban regeneration and compact urban planning can potentially help maintain the quality of life while using space more efficiently. Utilising the concept of the Brainport as a regional planning tool, rather than as a marketing strategy for the city, can help overcome the overemphasis on Eindhoven itself.

³¹ <https://www.cbs.nl/nl-nl/visualisaties/regionale-monitor-brede-welvaart/thema>

³² CBS dataset Population dynamics; birth, death and migration per region COROP:
<https://opendata.cbs.nl/#/CBS/en/dataset/37259eng/table?ts=1587377856868>

³³ Persons at risk of poverty or social exclusion by NUTS regions - EU 2020 strategy (ilc_peps11):
https://ec.europa.eu/eurostat/databrowser/view/ilc_peps11/default/table?lang=en

³⁴ <https://globaleurope.eu/globalization/globalisation-eindhoven/>

³⁵ https://brainporteindhoven.com/fileadmin/user_upload/map_2021/Brainport_Agenda_summary_EN_LR.pdf



The potential land use effects on Eindhoven and Zuidoost-Noord-Brabant will be driven by expected further economic growth, mostly in the technological sphere and industry. As a key location for semiconductor production and an established technological centre, Eindhoven and the region are well-positioned to utilise their competitive advantage and continue growing. Their strategic importance on European and global level will likely further enable this growth. As a result, further expansion of industrial land use can be expected. As a follow up effect, the better economic prospects can fuel migration, and this can have further expansive effects on residential land use. As a region with very high share of natural and agricultural areas, the conflict between potential expansion of the built environment and the preservation and expansion of natural and agricultural areas can create challenges in planning. The potential further expansion of urban centres in Zuidoost-Noord-Brabant is in-line with the vision of the current NOVI strategy on expanding the Netherlands Urban Network (BZK 2020). The further development of Eindhoven and its region would have to balance between the urban ambitions to ensure strong, attractive, and healthy cities and the economic viability of agriculture in the region, together with preserving and improving quality of life in both rural and urban areas.

Table 4 presents a summarised version of the potential land use impact on Zuidoost-Noord-Brabant and Eindhoven. The significant shares of transport land use on regional and urban level are expected to expand further to achieve the objectives on sustainable transport (EGD-P1). Expansion of existing transport links as a result of expected economic growth can also contribute to this increased demand. The already high shares of residential land could increase as a result of expected economic growth and attractiveness for migration. The already high shares of industrial and office land can further expand to accommodate space for renewables (EGD-P1, trend Shift to renewables-T1), to locate new production facilities of the circular economy (Circular economy strategy-P2), to accommodate further growth of key industries, especially technology and semiconductors (Europe fit for the Digital Age – P5, Accelerated digitalisation – T3). The current land use distribution indicates a significant concentration of those in Eindhoven, which may lead to issues of densification. Large shares of agricultural land on regional level will need to accommodate the transition to organic and sustainable agriculture. Large shares of contribute to national targets for natural land and protected areas. These areas can be threatened by conversion due to the expansion of industrial areas, especially due to their proximity to urban limits.



Zuidoost-Noord-Brabant. Eindhoven.							
Land use category	Transport (no water)	Inland water	Residential	Industrial	Greenhouses	Other agricultural usage	Woodland and nature
Policy-Trend/% of total surface as compared to nat. share-Zuidoost-Noord-Brabant	3,12%	1,31%	8,86%	2,90%	0,29%	52,11%	25,83%
% of total surface as compared to nat. share-Eindhoven	16,75%	1,37%	28,21%	19,50%		11,32%	11,09%
P1 European Green Deal	Expansive		Inconclusive	Restrictive	Expansive	Expansive	Expansive
P2 EU Circular Economy Action Plan and Strategy	Restrictive		No impact	Expansive	No impact	No impact	Expansive
P3 EU Biodiversity Strategy	No impact		Restrictive	Restrictive	Expansive	Expansive	Expansive
P4 Connecting Europe Facility	Expansive		Expansive	Inconclusive	No impact	Inconclusive	No impact
P5 Europe Fit for the Digital Age	No impact		Expansive	Expansive	No impact	Restrictive	Restrictive
T1 Increasing shift to renewables	No impact		Expansive	Expansive	No impact	Restrictive	Restrictive
T2 Working from anywhere	Inconclusive		Expansive	Restrictive	No impact	No impact	No impact
T3 Accelerated digitalization and omnichannel futures	Restrictive		Expansive	Expansive	No impact	No impact	No impact
T4 Global geostrategic plans of others (outside of Europe)	No impact		Expansive	Expansive	No impact	No impact	No impact
T5 Tyranny of merit	No impact		Expansive	Inconclusive	No impact	No impact	No impact
Potential land use impact specific to the region	Potential expansion of transport infrastructure, including waterways, to achieve objectives on sustainable transport. Potential further expansion of transport infrastructure as a result of economic growth.		Expected further expansion of residential areas because of increased migration thanks to expected economic growth. Densification issues. Some potential to offset pressure through cross-border labour markets.	Further expansion to accommodate renewables unless residential area or dual land use is used. Expected expansion due to economic growth in key industries, especially semiconductor s. Further pressure to expand for circular production. Densification issues in Eindhoven.	Vast shares of agricultural land will need to accommodate transition to organic and sustainable agriculture. Can be threatened by conversion due to industrial land expansion, including renewable energy. Conflicting interests on regional level between economic growth in urban centres and growth in agricultural areas.		Potential to contribute to national targets for natural land and protected areas. Can be threatened by conversion due to industrial land expansion. Protected areas are very close to settlement limits.

Table 4 - Summary of potential land use impact of EU policies and global trends on Zuidoost-Noord-Brabant and Eindhoven. The land use percentage measurements on row 2 and 3 in the table show the share of the specific type of land use in the respective case study. The percentage is calculated by dividing the area of each specific land use type in hectares by the total area of the region or city in hectares and thus results in the share of this type of land in the specific case. The colour-coding indicates if the calculated share is lower or higher than the share of the same land use type on national level.



6.5 Zuid-Limburg (COROP region)

Zuid-Limburg is a region in the south of the Netherlands with a hilly landscape and a history of mining. A diverse urban and rural landscape with Maastricht being the main urban centre while Heerlen and its agglomeration act as a secondary urban centre. This moderately densely populated region with some 600 000 people (more than 50% of the population of the province) is at a strategic location on the borders with Belgium (Flanders, Wallonia and German-Speaking community) and Germany (North-Rhine Westphalia) as part of the Euroregion-Maas-Rhine. The region is part of the province of Limburg and is rather small with an area comprising of 66 056 ha.

Land use profile

The region has a higher share than the national shares of transport, residential and industrial and office areas than the national shares of those land use types. The share of agricultural land (Other) is also high, but close to the national share. The share of residential land use is second highest as compared to other COROP regions. The share of transport land use is comparatively high and similar to the Randstad area (CBS Land use; all categories, municipalities; COROP regions, 2015).

Potential land use impact of EU policies and global trends on Zuid-Limburg

The southernmost region of the Netherlands is a densely populated area, home to more than 50% of the population of the Limburg province (more than 600 000 people live in Zuid-Limburg). The land use in the region is predominantly agricultural with 54.72% of the land in this category, close to the national share. The region also has higher shares of residential land use, as well as industrial and transport. The higher industrial share is related to the region's history of mining and the transition of some of the industrial facilities to new forms of production.

The agricultural land share is high and close to the national share. Respectively, this land use will need to accommodate the ambitions of the EGD (e.g., policy objective 'More sustainable food production' - P1.2.) for further expansion in order to achieve the transition to organic and sustainable agriculture. The strong tradition in this sector can accommodate this transition by exploring different solutions, including potentially non-soil bound agriculture. The natural areas are lower than the national share and can be subject to further expansion in order to meet the rest of the green transition targets, pertaining to expanding and protecting nature (EGD-P1, Biodiversity strategy-P2). The expansion of both natural and agricultural land can be challenging due to the very high shares of transport, residential and industrial and office areas. In case the latter three also expand, this can create challenges on regional level and threaten the natural and agricultural areas.

The region already has a very high share of transport land use which is expected to further increase. Due to the peculiar location of the region – geographically distanced from the rest of the country and nestled between Germany and Belgium – it is likely that transport infrastructure will remain or will continue to be expanded. Additionally, transport land use is expected to increase to facilitate the completion of the pending TEN-T project for the expansion of the Maasbracht-Limmel waterway (policy CEF – P4). As a cross-border region, there is a higher likelihood for further expansion of transport land



use to ensure connectivity of the cross-border region. This further increase can create challenges and indicate a higher risk of conversion of agricultural land.

Industrial land use can potentially increase due to the need to allocate space for renewable energy projects (policy objective 'Affordable clean energy' - P1.5., trend Shift to renewables - T2). This can be problematic due to the already high share of industrial land. A possible way to address this is to utilise underused or abandoned industrial areas. Some of the needs for more space for renewable energy can be compensated by using the existing built environment, especially of residential type due to its very high share in the region. As a border region, Zuid-Limburg can also explore cross-border renewable energy partnerships (policy objective 'TEN-E' - P4.2.).

Further industrial and office land expansion can be expected as a result of the potential economic growth of the region. Zuid-Limburg has some potential for further growth due to its strong history in mining and industry as well as its location between Germany and Belgium. As an inland region, Zuid-Limburg can be a suitable location for critical computing capacity (policy Europe Fit for the Digital Age - P5). The University of Maastricht can also contribute to technological growth with its research in engineering. A European office of the health-tech company Medtronic is located in the city of Heerlen (trend Accelerating digitalisation-T3). The region's competitiveness is also strongly supported by existing companies in the chemical industry and manufacturing as well as advanced agricultural and food production sectors. These sectors can further expand to support the circular economy transition and the green transition (EU Circularity strategy-P2, EGD-P1). As a home to the NATO headquarters Allied Joint Force Command Brunssum' (JFCBS), Zuid Limburg's strategic importance can increase, due to the geopolitical instability, and potentially more investment in this strategic military facility can increase its contribution to the regional economy (trend Global geostrategic plans of others – T4). Paired with its position as a cross-border region, Zuid-Limburg has potential for further growth. This can lead to further expansion of industrial areas and offices. Some of this pressure can be offset by more remote working (trend Working from anywhere - T2), but this will likely be limited due to the nature of the economic activities in the region.

The potential for economic growth can lead to increased migration and respectively increased demand for residential land. The share of this type of land is already very high, so these effects may lead to densification challenges in some parts of the region. Further expansive effects on residential land use can come from the impacts of increasing digitalisation (trend Accelerated digitalisation - T3) as well as from any potential migration waves to the region (trend Geostrategic plans of others - T4). Its attractiveness as a university region can also contribute to this. As a result, residential land use demand can increase on regional level. Its further expansion, beyond its current very high share, can create challenges to accommodate conflicting needs between this expansion and the expansion of natural and agricultural areas.

Pressure on residential and industrial land use can be potentially offset through cross-border cooperation. The favourable geographic location of the region and its cultural proximity to its neighbours in the Euroregion-Maas-Rhine can enable a well-functioning cross-border labour market and, respectively, allow for more commuting from across the border. This could decrease the potential expansive effects on both industrial and residential land use. Local authorities are already working in



this direction.³⁶ This approach can also offset some of the minor population decline effects that the region is experiencing ($\pm 1\%$ population decline since 2010, CBS³⁷). Increased cross-border cooperation may compensate the low scores³⁸ in overall employment (65.2%, last place in the Netherlands) or improve the satisfaction of citizens with their living environment and housing (35th and 33rd place out of 40 in the Netherlands). Additionally, the region is at the last place in terms of self-reported health status with only 38,2% reporting good or very good health. Cross-border service provisioning can potentially provide more accessibility to health services (European Commission 2017) (in addition to the potential benefits of digitalisation in healthcare from trend T3) and contribute to improvements in quality of life. In addition to those scores, the region also scores low on trust in others and volunteering, indicating that the social cohesion may be under threat (trend Tyranny of merit - T5). The results from the recent provincial elections also suggest existing divisions within the region with the major urban centres of Maastricht and Heerlen voting predominantly for established parties while the rest of the region supported BBB.

The potential land use impact on Zuid-Limburg will mostly be driven by its potential for growth and its cross-border location. These factors can lead to more economic growth and, respectively, further increase of industrial and office areas. Consequently, migration could lead to population growth, and this can lead to further pressure on residential land use. Both of those land use shares are very high in the region. At the same time, the region also has a very high share of agricultural land. Respectively, there will be challenges in accommodating these two tendencies and this can create difficulties for regional planning to minimise the risk of agricultural land conversion. In-line with the current NOVI strategy (BZK 2020), maintaining and improving the access to the Netherlands Urban Network will require interventions in transport infrastructure in Zuid-Limburg. At the same time, the region would have to balance quality of life, economic competitiveness of cities and economically viable agriculture.

Table 5 presents a summarised version of the potential land use impact on Zuid-Limburg. Transport land use is expected to expand further to ensure connectivity to the rest of the country and in the cross-border region, as well as with the completion of pending TEN-T projects (CEF-P4). Residential land can potentially expand as a result of economic growth, although lower quality of life can present a challenge. Industrial and office space could also expand in case the potential for economic growth is realised to support circular economy transition (Circular economy strategy P2) or potentially some growth in technology industry (trend Accelerated digitalisation – T3, Europe Fit for the Digital Age – P5) and military (trend Geostrategic plans of others – T4). Vast shares of agricultural land will need to accommodate transition to organic and sustainable agriculture. Its potential expansion can be challenging due to the high shares of land of other types. The low shares of natural land could also be expanded, but this will be challenging due to the high shares of land of other types.

³⁶ <https://www.gemeentemaastricht.nl/en/city/recent/press-release/zuid-limburgs-long-term-approach-euroregional-labour-market>

³⁷ CBS dataset Population dynamics; birth, death and migration per region COROP:
<https://opendata.cbs.nl/#/CBS/en/dataset/37259eng/table?ts=1587377856868>

³⁸ <https://www.cbs.nl/nl-nl/visualisaties/regionale-monitor-brede-welvaart/thema>



Zuid-Limburg							
Land use category	Transport (no water)	Inland water	Residential	Industrial	Greenhouses	Other agricultural usage	Woodland and nature
Policy-Trend/% of total surface as compared to nat.share	4,54%	1,63%	15,73%	4,68%	0,00%	54,72%	8,53%
P1 European Green Deal	Expansive		Inconclusive	Restrictive	Expansive	Expansive	Expansive
P2 EU Circular Economy Action Plan and Strategy	Restrictive		No impact	Expansive	No impact	No impact	Expansive
P3 EU Biodiversity Strategy	No impact		Restrictive	Restrictive	Expansive	Expansive	Expansive
P4 Connecting Europe Facility	Expansive		Expansive	Inconclusive	No impact	Inconclusive	No impact
P5 Europe Fit for the Digital Age	No impact		Expansive	Expansive	No impact	Restrictive	Restrictive
T1 Increasing shift to renewables	No impact		Expansive	Expansive	No impact	Restrictive	Restrictive
T2 Working from anywhere	Inconclusive		Expansive	Restrictive	No impact	No impact	No impact
T3 Accelerated digitalization and omnichannel futures	Restrictive		Expansive	Expansive	No impact	No impact	No impact
T4 Global geostrategic plans of others (outside of Europe)	No impact		Expansive	Expansive	No impact	No impact	No impact
T5 Tyranny of merit	No impact		Expansive	Inconclusive	No impact	No impact	No impact
Potential land use impact specific to the region	Potential expansion to ensure connectivity to the rest of the Netherlands and abroad as well as the completion of pending TEN-T projects.		Can potentially increase further as a result of potential economic growth, despite low liveability scores.	Potential expansion to facilitate renewable energy sources. Some potential for expansion for new industrial facilities in circular economy and potential growth in technology sector.		Vast shares of agricultural land will need to accommodate transition to organic and sustainable agriculture.	Lower shares of natural areas can be potentially expanded, but the expansion can be challenging due to high shares of agricultural and residential land use.

Table 5 - Summary of potential land use impact of EU policies and global trends on Zuid-Limburg. The land use percentage measurements on row 2 in the table show the share of the specific type of land use in the respective case study. The percentage is calculated by dividing the area of each specific land use type in hectares by the total area of the region or city in hectares and thus results in the share of this type of land in the specific case. The colour-coding indicates if the calculated share is lower or higher than the share of the same land use type on national level.



7 Conclusions

The reviewed policies and global trends indicate diverse and overlapping impacts on different types of land use. From the perspective of different territories and scales, such as the selected case studies, these potential effects create challenges from land use perspective. Their influence on the land use can be disproportionate for different territories due to their current land use profiles. However, since these territories are part of one country, the disproportionate effects can be potentially compensated with planning at a larger or national scale. The challenge to balance the different demands on the diverse types of land use can also open opportunities for regional and national planning.

One of the biggest land use challenges is the management of natural and agricultural land. The reviewed EU policies, especially the ones addressing the green transition, such as the European Green Deal and its associated policies, are rather clear that the broader objectives require expansion of agricultural and natural areas. As indicated in the reviewed case studies, some of them have a large share of those land use types (e.g., De Achterhoek and Delfzijl). With that said, the key challenge would be to either view these land use shares as a standalone regional bandwidth or as a potential on national level in order to achieve the national targets of the EU policies. If viewed from regional perspective, the further expansion of agricultural and natural land and the subsequent restrictive approach to urban sprawl and built environment will limit urban sprawl in order to avoid land conversion. From a national perspective, regions with high shares of natural and agricultural land can potentially offset the increased built land use in highly urbanised regions and economic centres. The expansion of agricultural areas in terms of more sustainable and organic produce can represent a challenge for agricultural practices with high intensity, which are well-established in the Netherlands. This, however, will not solve the challenges in the immediate vicinity of urban centres such as Rotterdam and Eindhoven. To mitigate the risk of further sprawl, those larger cities can explore compact urban planning focusing on regeneration and multifunctional land use, increase density (incl. vertically) can contribute to maintaining or improving spatial quality and balance the competing demands. The new spatial policy document suggests a more directing role for the central government in spatial planning with a consideration for balanced development. This approach may align with the decisions about the trade-off between natural and agricultural expansion and built environment. Stronger considerations for territorial specifics would be beneficial to ensure that the trade-offs on regional level are acceptable.

The green transition will require further expansion of renewable energy infrastructure. For large scale projects, this can increase the demand for industrial land and create challenges on regional level. Regions closer to the North Sea coast generally have more favourable conditions for wind energy. Accommodating such larger projects can often result in the need for land conversion of agricultural and natural areas, unless solutions such as dual land use are explored (e.g., agrivoltaics). The reviewed cases indicate a strong potential for further cross-border cooperation in the renewable energy field which may potentially offset land use pressure from within the Netherlands. Regions and cities with large shares of residential area, such as Zuid-Limburg and Eindhoven, can explore small scale solutions for households by utilising the existing built environment. In the context of the new spatial policy document *Nota Ruimte*, further considerations for energy production ought to be included, not least in the context of climate change and the phasing out of fossil fuels (such as the gas field in Groningen, near the case study of Delfzijl).



Transport land use, specifically railway and waterways, is also expected to expand, in line with the green transition objectives. In the context of this study, specific focus was placed on the TEN-T network. The majority of projects of this network have been completed within the Netherlands. One of the pending ones is the expansion of the Maasbracht-Limmel waterway in Zuid-Limburg. Due to the expected economic growth of the main urban centres from the case studies (Rotterdam, Eindhoven), further pressure for expansion of transport infrastructure can be expected. This can partially be compensated with new forms of industrial areas with more proximity.

Drivers of economic growth can be the technology sector and the transition to circular economy. Their further expansion will lead to increased demand for industrial and office space, especially in more competitive regions, such as Rotterdam and Eindhoven. Eindhoven is also in a competitive position to grow as a result of its strong semiconductor industry – a strategic priority of the EU. This places Eindhoven and the Brainport region at the forefront of the digital transition. The need to construct new critical computing facilities can be an opportunity for inland regions to attract investment in this area. The potential further growth of the global economy will contribute to the importance of major ports, such as Rotterdam. Their key locations and strategic role on European and global level will likely fuel their growth. The prospects of smaller ports, such as Delfzijl, will depend on their market strategy. All those drivers will increase the demand for industrial and office space and create challenges in accommodating this expansion without converting natural and agricultural land. Better regional planning, aiming for balanced development and on a larger scale may be suitable. At the same time, the international profile and importance of these industries indicates how vulnerable they are to global shifts and dependencies, including in terms of raw materials and international trade dynamics. Respectively, the new spatial policy document *Nota Ruimte* would need to take into account these shifts and also consider the economic factors on local, regional, national and European scale.

Economic growth, societal divisions and major international crises can fuel migration. The increased usage of technology in everyday life can prompt more people to work and spend time at home. As a result of those factors, further pressure can occur on residential land use. For regions with high quality of life and better economic prospects, this can create further growth challenges. Regions with lower attractiveness or economic prospects can be negatively impacted and lose population. Placing a priority on quality of life in all regions in the Netherlands, as stipulated in the priorities of *Nota Ruimte*, can ensure better living conditions in different territories. The necessary infrastructure and public services need to be in place as part of the measures for social value, community building and quality of life, stipulated in the new spatial policy document.

The vision of *Nota Ruimte* to preserve and develop the distinctive strength of all parts of the country while eliminating major spatial differences may be challenging. It can exert difficult decisions and a high level of uncertainty for the different territories:

- Coastal regions with smaller ports and higher agricultural and natural land use shares, such as Delfzijl, will need to address the potential challenge to balance the expansion of their port infrastructure to become more competitive as opposed to preserving their vast shares of natural and agricultural land; all in the context of rising sea levels.



- Peripheral rural agricultural regions, such as De Achterhoek, can become places of refuge for remote workers, offsetting pressure on bigger cities. At the same time, they can play an important role on national level to offset carbon footprint with their vast shares of agricultural land.
- Highly competitive regions with nationally and globally strategic transport infrastructure, such as Rotterdam, can experience further pressure to retain or even advance their position at the expense of further sprawl or further intensive densification – a setting that can trigger issues of growth, housing accessibility and threaten the quality of life. Balancing those considerations, both locally and nationally, can be difficult.
- Regions with vast protected areas, such as Zuidoost-Noord-Brabant, can be a posterchild for European environmental protection. Technological leaders and emerging global cities such as Eindhoven, nestled in the region, can be forced to further densify and experience similar challenges to Rotterdam. Urban versus regional scale planning can become central, especially for areas strategically important for the Netherlands and the EU.
- Large cities and economically active regions can continue to experience further population growth due to their higher attractiveness and perceived better life chances. A balanced internal and external migration management can soften the pressure on land use in major urban centres and potentially support less developed regions.
- Balanced regions with a specific location and unique character, such as Zuid-Limburg, can benefit from their distinctive position. Creating vital and functioning cross-border cooperation zones can relieve regions from the daunting of ‘fitting’ all services, people, and economy into scarce space.
- While the EU policies pertaining to the transition of agriculture to more sustainable practices imply overall expansion of the land, they can be particularly challenging for areas with hyper-intensive agricultural practices. Balancing the need to reduce pollution and to improve efficiency of sustainable food production will be difficult to achieve.

The potential impact of EU policies and global trends should be viewed in a broader context, beyond the boundaries of the Netherlands. The ambitions for environmental transition and decrease of pollution will also depend on national decisions and policies and their implementation in the specific territorial context of the different regions of the country. These efforts should also be viewed in the context of the Territorial Agenda 2030³⁹: achieving a balanced development between improved working and living conditions while also contributing to the global competitiveness of the EU; developing well-functioning regions through place-based strategies within and beyond national borders; ensuring sustainable digital and physical connectivity between places. The necessary balance and difficult decisions on regional and national level ought to also be taken in the context of climate change so as to ensure a future perspective to communities and places.

³⁹ <https://territorialagenda.eu/>



8 Annexes



ANNEX 1 – EU POLICIES AND GLOBAL TRENDS – POLICY OBJECTIVES AND TREND ELEMENTS

Code	Policy or trend	Policy objective/ Trend element Code	Objective/Element	Thematic cluster
P1	European Green Deal (2030 and 2050)	P1.1.	Improve the condition of the environment: Improve the condition of the environment by decreasing the pollution of air, water, soil and consumer products as well as by enhancing biodiversity and ecosystems through re- and afforestation to increase CO2 absorption.	Environmental
P1	European Green Deal (2030 and 2050)	P1.2.	More sustainable food production: More sustainable food production and food security through improved use of aquatic and marine resources as well as increase of organic farming (less fertilisers and pesticides, more sustainable agriculture practices).	Environmental
P1	European Green Deal (2030 and 2050)	P1.3.	Smart and sustainable mobility: Shift towards smart and sustainable mobility by increasing multimodality and the share of railway (triple high-speed rail traffic by 2050) and inland waterway transport as well as a decrease of aviation transport to decrease GHG emissions from the transport sector to 0 until 2050 (90% reduction of GHG by 2050: min. 30 million zero-emission vehicles by 2030, nearly all by 2050, zero-emission vessels and aircraft) and reduce its fuel demand.	Environmental
P1	European Green Deal (2030 and 2050)	P1.4.	Double energy renovation rate: Double the energy renovation rate to make the building and renovation sector more resource efficient, reduce emissions and energy poverty	Environmental
P1	European Green Deal (2030 and 2050)	P1.5.	Affordable clean energy: Make clean and secure energy affordable for everybody through an increased share of renewable energy sources and improvement in energy efficiency.	Environmental
P2	EU Circular Economy Action Plan and Strategy (±2050)	P2.1.	Sustainable products: Making sustainable products the norm in the EU - durable, repairable and recyclable.	Environmental



P2	EU Circular Economy Action Plan and Strategy (±2050)	P2.2.	Empowering consumers: Empowering consumers and public buyers through transparency and information.	Environmental
P2	EU Circular Economy Action Plan and Strategy (±2050)	P2.3.	Circular value chains: Increase the circularity among value chains (especially electronics, batteries and vehicles, packaging, plastics, textiles, food, water and nutrients).	Environmental
P2	EU Circular Economy Action Plan and Strategy (±2050)	P2.4.	Reduce waste: Reduce total waste generation and halve the amount of residual (non-recycled) municipal waste by 2030.	Environmental
P2	EU Circular Economy Action Plan and Strategy (±2050)	P2.5.	Circularity accessible: Make circularity accessible for people, regions and cities.	Environmental
P3	EU Biodiversity Strategy 2030	P3.1.	Protect nature (Establishing a larger EU-wide network of protected areas on land and at sea)	Environmental
P3	EU Biodiversity Strategy 2030	P3.2.	Restore Nature (Launching an EU nature restoration plan)	Environmental
P3	EU Biodiversity Strategy 2030	P3.3.	Enable Transformative Change (Introducing measures to enable the necessary transformative change)	Environmental
P3	EU Biodiversity Strategy 2030	P3.4.	EU for an ambitious global agenda (Introducing measures to tackle the global biodiversity challenge)	Environmental
P4	Connecting Europe Facility (2021-2027)	P4.1.	TEN-T: Completion of TEN-T Core network by 2030 and of TEN-T Comprehensive network by 2050	Environmental
P4	Connecting Europe Facility (2021-2027)	P4.2.	TEN-E: Establish a more interconnected, smarter and digitalised TEN-E by removing bottlenecks and improving market integration (incl. cross-border) and thus contribute to main objectives of the EGD	Environmental
P4	Connecting Europe Facility (2021-2027)	P4.3.	TEN-Telecom: Improve digital connectivity and digital market in the EU through investment in digital infrastructure and broadband connectivity	Technology and digital
P5	Europe Fit for the Digital Age 2030	P5.1.	EU semiconductor leader: Double EU's global production capacity of semiconductor chips to 20% global share	Geopolitics and key industries
P5	Europe Fit for the Digital Age 2030	P5.2.	EU critical computing capacity: Develop EU's critical computing capacity in industry and R&D	Technology and digital
P5	Europe Fit for the Digital Age 2030	P5.3.	AI in agriculture: Increase the adoption of AI in agriculture through new instruments and data	Technology and digital
P5	Europe Fit for the Digital Age 2030	P5.4.	EU AI hub: Develop EU as a global hub for AI research and development for business, industry and science	Technology and digital



P5	Europe Fit for the Digital Age 2030	P5.5.	EU strategic autonomy and US: Strengthen EU's open strategic autonomy through improved supply of critical materials and closer cooperation in trade and strategic decisions with the USA	Geopolitics and key industries
T1	Environmental: Increasing shift to renewables	T1.1.	Need for renewable energy: Growing need for renewable energy	Environmental
T1	Environmental: Increasing shift to renewables	T1.2.	Policy for renewables: Policy support for achieving shift to renewables	Environmental
T1	Environmental: Increasing shift to renewables	T1.3.	Research on renewables: Increase of research and development in renewable energy technology	Environmental
T1	Environmental: Increasing shift to renewables	T1.4.	Awareness of renewables: Raising public awareness and involvement of public in shift to renewables	Environmental
T1	Environmental: Increasing shift to renewables	T1.5.	Investment and jobs in renewables: Increasing investment in renewable energy production & need for skilled workers	Environmental
T2	Economic: Working from anywhere	T2.1.	Flexible work arrangements: Work arrangements become more flexible (domestic remote working/hybrid solutions)	Technology and digital
T2	Economic: Working from anywhere	T2.2.	Cross-border remote working: Increase of cross-border remote working from one determined place (freedom of labour in the EU)	Technology and digital
T2	Economic: Working from anywhere	T2.3.	Digital nomadism: Digital nomadism (working while travelling) and freelancing become more popular.	Technology and digital
T2	Economic: Working from anywhere	T2.4.	New work regulations: New tax and social security regimes in the EU to accommodate changing working habits	Technology and digital
T2	Economic: Working from anywhere	T2.5.	Social division: Increasing societal polarisation between those who can work remotely and those who can not	Technology and digital
T3	Technological: Accelerated digitalisation and omnichannel futures	T3.1.	Technology in health: Wider adoption of technology for prevention, monitoring, consultation and treatment in health	Technology and digital
T3	Technological: Accelerated digitalisation and omnichannel futures	T3.2.	Technology in education: Wider adoption of digital solutions for education (incl. remote education)	Technology and digital
T3	Technological: Accelerated digitalisation and omnichannel futures	T3.3.	Digital alternatives: Wider adoption of digital alternatives to physical reality (incl. immersive technology, AR/VR)	Technology and digital



T3	Technological: Accelerated digitalisation and omnichannel futures	T.3.4	Online trade expansion: Further expansion of online trade and parallel/converging commercial activity offline and online	Geopolitics and key industries
T4	Political: Global geostrategic plans of others (outside of Europe)	T4.1.	US and China tech supremacy: US and China continue international trade race, incl. in semiconductor industry, and sidetrack EU	Geopolitics and key industries
T4	Political: Global geostrategic plans of others (outside of Europe)	T4.2.	China and Russia influence: China shifts focus of external investments and influence to Middle East, Caucasus, Central Asia and Africa in alignment with Russia.	Geopolitics and key industries
T4	Political: Global geostrategic plans of others (outside of Europe)	T4.3.	India-Pakistan conflict: Escalation of conflict between India and Pakistan in Kashmir	Geopolitics and key industries
T4	Political: Global geostrategic plans of others (outside of Europe)	T4.4.	US-Iran confrontation: US engages in military intervention in Iran to achieve regime change	Geopolitics and key industries
T4	Political: Global geostrategic plans of others (outside of Europe)	T4.5.	QUAD cooperation: QUAD (Australia, India, Japan, USA) establishes control over the Indo-Pacific region (instead of China)	Geopolitics and key industries
T5	Social: Tyranny of merit	T.5.1	Income inequality: Continuous increase of income inequality (national and global)	Geopolitics and key industries
T5	Social: Tyranny of merit	T5.2.	Inequality of opportunity: housing, lack of social services, decreased social chances	Geopolitics and key industries
T5	Social: Tyranny of merit	T5.3.	Inequality in labour: Hierarchy of labour market chances and lowered social mobility	Geopolitics and key industries



ANNEX 2 – EU POLICIES AND GLOBAL TRENDS – POLICY OBJECTIVES AND TREND ELEMENTS

P1: European Green Deal	
Policy name	European Green Deal
Broader category	Political
Policy area	Multiple (high level policy)
Method of delivery	Regulations, revision of regulations, funding, technical assistance, strategies
Time horizon	2030/2050
Main policy objectives	
P1.1. Improve the condition of the environment: Improve the condition of the environment by decreasing the pollution of air, water, soil, and consumer products as well as by enhancing biodiversity and ecosystems through re- and afforestation to increase CO2 absorption.	
P1.2. More sustainable food production: More sustainable food production and food security through improved use of aquatic and marine resources as well as increase of organic farming (less fertilizers and pesticides, more sustainable agriculture practices).	
P1.3. Smart and sustainable mobility: Shift towards smart and sustainable mobility by increasing multimodality and the share of railway (triple high-speed rail traffic by 2050) and inland waterway transport as well as a decrease of aviation transport to decrease GHG emissions from the transport sector to 0 until 2050 (90% reduction of GHG by 2050: min. 30 million zero-emission vehicles by 2030, nearly all by 2050, zero-emission vessels and aircraft) and reduce its fuel demand.	
P1.4. Double energy renovation rate: Double the energy renovation rate to make the building and renovation sector more resource efficient, reduce emissions and energy poverty.	
P1.5. Affordable clean energy: Make clean and secure energy affordable for everybody through an increased share of renewable energy sources and improvement in energy efficiency.	
Justification for the selection of the objectives	
<p>The selection of objectives was based on the following 8 thematic fields of the European Green Deal:</p> <ol style="list-style-type: none"> 1. A zero-pollution ambition for a toxic-free environment 2. Preserving and restoring ecosystems and biodiversity 3. From "Farm-to-fork": a fair, healthy, and environmentally friendly food system 4. Accelerating the shift to sustainable and smart mobility 5. Increasing EU's climate ambition for 2030 and 2050 6. Supplying clean, affordable, and secure energy 7. Mobilising industry for a clean and circular economy 8. Building and renovating in an energy and resource efficient way <p>In order to break the overlapping thematic fields down to objectives and since several initiatives and strategies that are part of thematic fields are already addressed in other policies in this study, components from each thematic field were chosen and compiled in the five chosen objectives.</p> <p>Objective P1.1. (Improve the condition of the environment): The part of thematic field 2 concerning the increased CO2 absorption through improved biodiversity and ecosystems, the component of thematic field 3 on reduced nutrient and urban run-off, thematic field 1 and the part of thematic field 5 related to the Land use, Land-Use Change and Forestry sector were included. The Biodiversity Strategy (thematic field 2) was not considered under this policy since it is covered separately under policy P3 (Biodiversity strategy).</p>	



Objective P1.2. (More sustainable food production): It is compiled of the part of thematic field 2 on the improved use of aquatic and marine resources as well as the remaining components of thematic field 3 concerning fair healthy and environmentally friendly food production and food security.

Objective P1.3. (Smart and sustainable mobility): It includes the components of thematic field 7 except for the TEN-T initiative, which is addressed through policy P4 (CEF) in this study.

Objective P1.4. (Double energy renovation rate): The thematic field 8 is addressed in this objective.

Objective P1.5. (Affordable clean energy): It includes the components of thematic field 6 except for the TEN-E initiative, which is addressed through policy P4 (CEF) in this study.

Further details on the formulation of objectives for the European Green Deal can be found in the respective chapter of the report.

Sectoral impact estimate

Politically, the achievement of all five objectives will lead to the strengthening of EU policy through revising existing policies in alignment with the EGD and the development of new strategies and regulations. This concerns EU-wide regulations and the development of national strategies and targets.

In the economic sector, different impacts will become visible immediately and secondarily. Due to the required adaptation of processes e.g., in food production, agriculture, construction and renovation, there will be an economic transition phase for some sectors in which the economic performance will first decline. Although this phase will eliminate some companies, especially SMEs, which are not able to cope with the adaptation efficiently enough, long-term it will result in new market opportunities and the creation of new jobs in most sectors. This will increase the competitiveness of regions coined by certain industries but can also get others left behind. Since the EGD stipulates an expected decrease in air and coach transportation, another direct impact will be the economic decline of the aviation and coach service services, leading to the loss of jobs in those sectors. However, many sectors get strengthened due to their prioritization as part of the implementation of the EGD, like fishing, sustainable agriculture, green construction, railway, and waterway transport as well as green energy production and storage. A secondary effect will be the increased independence of the EU food market and security, leading to less import of goods. The increased focus on green renovation activities will, on the one hand, put pressure on the availability of (sustainable) construction material and, on the other hand, it will lead to less construction of new buildings, adding pressure on the housing market. Additionally, there will be a shortage of special skilled labour force, which accounts for many sectors and requires (re-)education measures.

The achievement of the objectives will impact the social dimension immediately. These effects will either shift over time or will lead to further impacts. First of all, the aforementioned loss of jobs and challenged SMEs will disproportionately affect some sectors and social groups. However, after the adaptation of the market to the new standards this inequality would be compensated in the long run. The energy renovation wave will on the one hand reduce energy poverty and increase social justice but on the other hand, this will take place at different speed in different regions and countries, increasing regional disparities. In addition, construction generally causes stress through pollution and enhanced noise. The standards for a more sustainable food production will at first lead to an increase of prices, enhancing social disparities and making healthy food more primarily accessible for people with higher income. After first transition phase, healthy and sustainably produced food becomes affordable and food security is strengthened, increasing social equality. It is likely to affect a long-term behavioural change and shift in market demands. The changes in food production also lead to better (mental) health and higher quality of life and wellbeing on the long perspective. This is also further enhanced through the development of more recreational areas and the processes related to mobility. As an immediate consequence, the costs for transport will increase due to the dependence on new technologies, infrastructure and fuels. This phase will further cut off left-behind regions. As these changes become more established and progressed, connectivity is enhanced



and becomes affordable which will lead to an increased mobility and use of public and multimodal transport systems.

In the environmental sector, many immediate factors will contribute to an improved functioning of ecosystems and increased biodiversity. These include less extraction of exhaustive resources (construction, energy, fossil fuel), more protected areas, reconstruction of downgraded natural areas and more forests, also resulting in a higher carbon absorption. In addition, reduced emissions related to transport, construction and renovation, heating, cooling, and energy production facilitate the improved long-term conditions of the environment. The higher share of organic farming inter alia contributes to less pollution of air, water and soil through e.g., fertilisers, pesticides, waste and other chemicals, which also improves biodiversity as well as human health. However, the increase of waterway transport endangers the ecosystem of waterbodies due to higher artificial intervention. In addition, there will be higher pressure on the marine ecosystems due to the reliance on fishing products as food supply, though after an adaptation phase the sustainable fishing practices should keep the ecosystem healthy and resilient.

All these adaptation processes are based on technological innovation, which will be facilitated through extensive investments. This concerns all mentioned sectors: food production, construction and renovation, agriculture and the utilisation of alternatives to pesticides and fertilisers, the development of alternative fuels to facilitate sustainable transport as well as innovative energy production and storage. However, it is likely that this innovation will go through a similar transition phase, in which funding and education is needed but also certain resources can become scarce.

Land use impact estimate	
Land use category	Anticipated impact
<i>Transport (incl. waterways)</i>	Expansive
<i>Built-up area-Residential</i>	Inconclusive
<i>Built-up area-Industrial area and offices</i>	Restrictive
<i>Agriculture-Greenhouses</i>	Expansive
<i>Agriculture-Other</i>	Expansive
<i>Woodland and nature</i>	Expansive

More *Transport (incl. waterways)* land use is also required for objective P1.3. (Smart and sustainable mobility) since it envisages the expansion of railway traffic and waterway use which includes port infrastructure (thus increase of *Built-up area-Industrial area and offices*) and the extension of rivers. In addition, improved connectivity can (re-)vitalise sub-urban and rural areas, enable commuting and attract economic activity and therefore take off pressure from densely populated, urban areas (decrease of use of *Built-up area-Industrial area and offices* and *Built-up area-Residential*). The focus of the construction sector on the renovation of existing buildings, limits the capacities to expand living spaces with new buildings. This slows down the continuous expansion of building construction, putting additional pressure on the housing market. This especially concerns urban areas or densely populated areas, which could lead to urban sprawl and more polycentric population patterns (thus inconclusive effects on *Built-up area-Residential*).

Residential areas and non-built-up areas might be more distanced from each other to prevent run-off (nutrients, urban run-off). The pressure on the conflict of use between built-up and non-built-up areas will increase, especially in densely populated areas (*Built-up area-Residential*). Natural areas will attract tourists, increasing the need for further protection and potential increase in *Built-up area-Residential* and *Transport (incl. waterways)* for extended touristic infrastructure.

The shift towards more organic, sustainable agricultural practices entails reduced productivity, leading to an increased need for agriculturally used land to achieve the adaptation (*Agriculture-Greenhouses* and *Agriculture-Other*). Additionally, nature-based solutions like buffer strips, hedges and terrace walls diversify the agriculturally used land. Innovative types of farming that are not soil bound (hydroponic,



circular systems, urban farming) could also take off pressure of the increased need for land due to their vertical dimension. Space for fishing infrastructure, processing and distribution is needed in coastal and marine areas, also requiring space for transport (*Transport (incl. waterways)*). Objective P1.5.(Affordable and clean energy) can put pressure on agricultural land use (*Agriculture-Other*), since these areas are typically required for renewable energy infrastructure (solar and wind energy). In built-up residential areas, smaller energy provision and distribution infrastructure could require an extension of land use (*Built-up area-Industrial area and offices*).

More *Woodland and Nature* land use is needed in order to increase biodiversity and especially to increase the contribution of land use to reducing emissions by increasing the area of carbon removals/sinks. Also, the need for natural construction resources requires more *Woodland and Nature* for wood production. Additionally, land is used more multifunctionally in non-built-up areas to increase biodiversity through nature-based solutions.

Dependence estimate

Objective P1.1. (Improve the condition of the environment): High dependence on the environment, since its condition significantly influences how successful the measures will be, if and how the biodiversity can be increased and how much carbon can be removed. Objective P1.2. (More sustainable food production): The objective is highly dependent on the political field since food production requires intervention into the food production through regulations and mainstreaming of information to change demands in order to shift the market from both ends towards a more sustainable and secure food chain. Objectives P1.3. (Smart and sustainable mobility), P1.4. (Double energy renovation rate) and P1.5. (Affordable clean energy): The objectives depend on technological development, as they all rely on progress in R&D in quality and quantity (alternative fuels and net-zero vehicles, more (efficient) renewable energies, increased energy efficiency in construction and more sustainable material use).

Uncertainty estimate

Climate related disasters, such as strong forest fires throughout Europe, can destroy many ecosystems and the highest carbon absorbing land use type (forest).

Overall probability estimate

0.63

P1.1. (Improve the condition of the environment): A zero pollution action Plan has already been adopted, a zero-pollution stakeholder platform is already implementing actions, the Chemicals Strategy was published in 2020 as part of the Zero Pollution Vision 2050. In addition, a legislative Framework for sustainable food systems will be adopted at the end of 2023. A new regulation on the land use, forestry, and agriculture (LULUCF) sector was proposed, strengthening its contribution to emission reduction by increasing the land use forms with carbon removal through binding national targets. P1.2.(More sustainable food production): The objectives are being implemented through e.g., the Farm-to-Fork strategy, but there is a discussion going on about the impact on agricultural production and how to prioritise food emergencies, like war or a pandemic against climate action. In addition, no impact assessment has been conducted yet, making it less likely. P1.3. (Smart and sustainable mobility): The mobility objectives are perceived as too ambitious with lack of concrete measures for the implementation. P1.4.(Double energy renovation rate): A clear quantitative goal has been determined for the energy renovation rate 2030, but afterwards it stays vague. This topic also seems to raise concerns about the administrative processes and questions of property and responsibility for renovation (landlords, tenants, municipalities). However, in 2023, the Energy Performance of Buildings Directive was adopted, setting minimum energy performance standards. P1.5. (Affordable clean energy): EU action on this objective stays rather vague and the implementation remains with MS. They



	<p>were required to adopt new long-term strategies for energy production, in alignment with the EGD (March 2023). The EGD itself shows no clear targets.</p> <p>The political context suggests that the objectives of the EGD can be achieved. This is e.g., based on the vote from the European Parliament from 18th April 2023 to reform the carbon market by limiting free CO2 permits for power plants and factories and imposing a CO2 levy on imports of resources like steel and cement in order to avoid imports from countries with more lax environmental rules. This is a significant legislative step of implementing the EGD. However, for some sectors, targets and measures for implementation are not always determined clearly, and their implementation depends heavily on national initiative. Due to its superordinate function, the EGD sets extensive ambitions for many sectors, decreasing the probability of achieving all of them.</p>
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FURTHER BACKGROUND INFORMATION

The European Green Deal (European Commission 2019) is generally a very broad, umbrella initiative influencing many targeted policies, the revision of policies, proposals, long-term plans, also on national level, and the alignment of existing policies with the climate-neutrality goal. The overall goal is an emission reduction of 55% until 2030 towards 1990 and a climate-neutral EU by 2050. Under this, the first objective (P1.1. – Improve the condition of the environment) of enhanced biodiversity, less pollution and increased carbon removal aims to increase the share of woodland and nature with the adoption of the Zero Pollution Action Plan, the Chemicals Strategy, a new regulation on the land use, forestry and agriculture sector (European Commission 2020d, 2021a, 2021c). Objective P1.2. (More sustainable food production) is mainly addressed through the Farm-to-Fork Strategy (European Commission 2020b) and sets goals for a more sustainable food production and food security in the EU. Objective P1.3. (Smart and sustainable mobility) sets ambitious targets with little measures for implementation (European Parliamentary Research Service and Pape 2021) for a shift towards a smart and sustainable mobility system in the EU by increasing multimodality, railway and inland waterway transport as well as a reduction of aviation and GHG emissions. It is mainly realised through the Strategy for sustainable and smart mobility and its according action plan (European Commission 2020e). Building and renovation (Objective P1.4. - Double energy renovation rate) is addressed through the concrete goal of doubling the energy renovation rate until 2030 and is legally embedded through the Energy Performance of Buildings Directive (European Commission 2021b), setting minimum energy performance standards as well as the Renovation Wave Strategy (European Commission 2020c). It focuses on the renovation of existing buildings. Objective P1.5. – Affordable clean energy concerns the provision of affordable, clean and secure energy with 90% reduction of emissions in the production until 2050. For this, MS revised and adopted new long-term strategies on national level in March 2023 in alignment with the EGD (European Commission 2023). In general, the land use impact of the EGD is very diverse and depends significantly on market reaction and technological progress. In addition, its environmental focus puts pressure on the common land use conflict between built-up area and natural area.



P2: Circular Economy Strategy and Action Plan	
Policy name	Circular Economy Strategy and Action Plan
Broader category	Technological
Policy area	Economy
Method of delivery	Regulations, labels, strategy development, technical and financial support for MS, revision of policies
Time horizon	2030/2050
Main policy objectives	
P2.1. Sustainable products: Making sustainable products the norm in the EU - durable, repairable, and recyclable.	
P2.2. Empowering consumers: Empowering consumers and public buyers through transparency and information.	
P2.3. Circular value chains: Increase the circularity among value chains (especially electronics, batteries and vehicles, packaging, plastics, textiles, food, water, and nutrients).	
P2.4. Reduce waste: Reduce total waste generation and halve the amount of residual (non-recycled) municipal waste by 2030.	
P2.5. Circularity accessible: Make circularity accessible for people, regions, and cities.	
Justification for the selection of the objectives	
<p>The selection of the objectives follows the structure of the Circular Economy Action Plan. It specifically considers key product value chains in an additional section, which were taken into consideration in this analysis under objective P2.3. (Circular value chains), since it addresses the technicalities of increasing the circularity among value chains. The action plan additionally addresses crosscutting actions and leading efforts at global level, which were not considered as relevant for the impact on the policy as sustainability norms (P2.1.), consumer empowerment (P2.2.), increased circularity (P2.3.), waste reduction (P2.4.) and circularity for regions and people (P2.5.).</p>	
Sectoral impact estimate	
<p>On a political level, the achievement of all objectives but especially of objectives P2.1. (Sustainable products) and P2.4. (Reduce waste) will lead to an immediate strengthening of EU laws and regulations regarding norms for products and the transparency on the value chain. This also accounts for standards of waste management among MS, leading to an adaptation of municipal planning.</p> <p>In the economic dimension, direct impact can be expected in changed production routines. Since companies need to adapt their workflows and processes, it is likely that there will be an economic transition phase with a temporary decrease of economic performance and competitiveness. This phase will be a challenge particularly for SMEs and will bring several of them out of business. The transition will be easier for larger enterprises. After this adaptation phase, the economic performance will increase again as new patterns and workflows stabilise and increasing trust and investments will make the circular production profitable. In the long run, the adapted value chain, design, and manufacturing will increase the lifespan of products and the share of durable goods on the market. This entails a more decentralised market due to the shift of focus towards repairing, maintaining, and adjusting products in many sectors, opening up diverse market opportunities especially for SMEs. The adaptation of the value chains also impacts external markets as there will be less importing of goods and resources as well as a reduced export of waste due to the increased re-use and recycling of material. Transport chains will be utilised differently, and transport patterns will change globally. The processes will also initiate a re-thinking of planning regarding industrial areas, the proximity of factories and processing facilities as well as the proximity of industrial sites to residential areas depending on the (re-)usability of side products of different sectors, e.g., produced heat. Along with the economic transition phase, higher prices for products require an increased initial investment despite the long-term profitability of products, depicting a barrier for people with lower income. This initial consequence affects the social dimension and leads to increased social disparities, which can trigger social opposition in various extents, e.g., rejection of sustainable products up to protests and revolt. On</p>	



the other hand, the achievement of all objectives entails the creation of a significant number of new jobs as well as opportunities for (re-)education and the obtaining of skills, increasing social justice. In any way, the consumer behaviour will change in the long run due to an adapted market and offer on the one hand. On the other hand, people get inspired due to the empowerment and knowledge about circularity, which shapes their own behaviour and demand, e.g., daily recycling, residual waste management and re-thinking the necessity of consumption.

The environmental sector will be influenced immediately through less impact of pollution, waste production and the reduced extraction of natural resources since they increasingly get replaced by sustainable and re-used material. In the long term, these improved conditions will lead to better functioning of ecosystems, their services and biodiversity.

The increased demand for recycling and sorting of used material as well as adapted production processes will lead to an increase in technological innovation in this field to adapt the economy.

Land use impact estimate

Land use category	Anticipated impact
<i>Transport (incl. waterways)</i>	Restrictive
<i>Built-up area-Residential</i>	No impact
<i>Built-up area-Industrial area and offices</i>	Expansive
<i>Agriculture-Greenhouses</i>	No impact
<i>Agriculture-Other</i>	No impact
<i>Woodland and nature</i>	Expansive

The achievement of all objectives and the estimated impacts will influence the different land use categories. Due to increased circularity of material and reduced import and export, the demand in transport will change: there will be quantitatively less freight traffic and it is going to decrease in distance. This reduced demand will impact the *Transport (incl. waterways)* restrictively. The increase of sorting, re-using, up- and recycling infrastructure requires extension of the *Built-up area-Industrial area and offices*. The increased production within the EU as well as the increase in waste management infrastructure for material sorting, disposal and recycling require a general increase of industrial sites. These will also diversify in structure since more and different steps of the value chains are located there. These circumstances will also extensively impact a land use category which is not included (dump sites). There will be no direct impact on both *Agriculture* categories, but the *Woodland and nature* will expand quantitatively and qualitatively long term due to improved functioning of ecosystems and less extraction of natural resources. The overall development will impact Member States on all levels differently. Small urban areas can either be boosted or get left behind depending on the economic structures regarding SMEs and large enterprises among the industries and national conditions. Therefore, the process will look different everywhere.

Dependence estimate

P2.1. (Sustainable products): The enabling of increased re-usability, use of recycled material and restriction of single-use products depends highly on the political conditions. EU-wide targets and regulations on establishing national targets have the potential to implement this objective. P2.2. (Empowering consumers): The targeted empowerment and particularly its effects on market demands for more sustainable products depend strongly on the social circumstances. P2.3. (Circular value chains): The increased circularity strongly depends on technological progress regarding materials, their re-usability, possibility to sort material for recycling and varies significantly among different sectors/resources. P2.4. (Reduce waste): The reduction of waste generation and insurance of value of thrown out material depends strongly on the political implementation of the objective, especially regarding the harmonisation of waste management and recycling regulations among the MS. P2.5. (Circularity accessible): the availability of circularity for people, regions and cities mostly depends on political circumstances. The main initiative for the implementation of this objective is the Circular Cities and Regions Initiative (CCRI) which aims to implement circular systemic solutions at local and regional level by providing assistance and funding projects. It runs under the HORIZON funding, like the whole Circular Economy Strategy. All



objectives are depending on the economic sector since whole value chains need to be adapted to achieve all objectives.

Uncertainty estimate

N/A

Overall probability estimate

0.74

P2.1. (Sustainable products): There are no specific targets set in the CEAP. It is implemented through the extension of the Ecodesign Directive, the proposal for a regulation on ecodesign for sustainable products and the implementation of a new Ecodesign and Energy Labelling Working Plan for individual product groups. P2.2. (Empowering consumers): The objective is implemented through the proposal for a directive on substantiation and communication of explicit claims (Green Claims Directive), a proposed consumer law including the "right to repair" and a proposal for a directive on empowering consumers in the green transition, mainly focusing on labelling, disclosure of information. The implementation is likely to be achieved. Only the transparency in many value chains depicts a challenge. However, the reception and targeted empowerment depend significantly on social circumstances. P2.3. (Circular value chains): The increased circularity among value chains in the EU is being implemented by supporting the sustainable and circular bio-based sector through the implementation of the Bioeconomy Action Plan, the Directive on common rules promoting the repair of goods (proposed in March 2023 by the European Commission), a new regulatory framework for batteries, building on the evaluation of the Batteries Directive, a review of the directive for packaging and packaging waste from 1994 and the Water Reuse Regulation. Circularity in building and renovation and well as sustainable food production are addressed under the EGD. P2.4. (Reduce waste): More likely due to quantitative target directly set in circularity action plan. Legal basis for the implementation is the review of the Directive 2008/98/EC on waste and repealing certain Directives.

FURTHER BACKGROUND INFORMATION

In general, the land use impact of the measures initiated through the objectives of the Circular Economy Strategy and Action Plan (European Commission 2020a) can be very diverse and depend strongly on the sector. They mainly include infrastructural facilities like waste, recycling, sorting and upcycling systems. Since a major part of the objectives concerns regulations for production, labelling and transparent information, the direct impact on land use is rather low or occurs as a second order consequence. The "soft" measures mostly depend on political decisions, which are currently in favour of this policy, increasing the probability of the achievement of the objectives. This concerns e.g., the vote from the European Parliament from 18th April 2023 to reform the carbon market by limiting free CO₂ permits for power plants and factories and imposing a CO₂ levy on imports of resources like steel and cement in order to avoid imports from countries with more lax environmental rules. Other (revised) regulations are: Green Claims Directive (European Commission DG Environment 2023), directive on empowering consumers in the green transition (European Commission 2022b), mainly focusing on labelling, the extension of the Ecodesign Directive (European Commission 2009), Bioeconomy Action Plan (European Commission DG RTD 2018), Batteries Directive (European Commission 2020f), review of the directive for packaging and packaging waste from 1994 (European Commission 1994) and the review of the Directive 2008/98/EC on waste and repealing certain Directive (European Commission 2008). However, missing reduction targets have been criticised and lower the probability of achievement. In addition, the increased circularity does not only depend on the political consensus among MS but also on technological progress and market reaction, enabling the re-use of material and development of recycled or bio-degradable alternatives.



P3: EU Biodiversity Strategy 2030	
Policy name	EU Biodiversity Strategy 2030
Broader category	Environmental
Policy area	Biodiversity
Method of delivery	Action plan, Financing from EU budget (contribution from the long-term EU budget 2021-2027)
Time horizon	2030
Main policy objectives	
P3.1. Protect nature (Establishing a larger EU-wide network of protected areas on land and at sea)	
P3.2. Restore Nature (Launching an EU nature restoration plan)	
P3.3. Enable Transformative Change (Introducing measures to enable the necessary transformative change)	
P3.4. EU for an ambitious global agenda (Introducing measures to tackle the global biodiversity challenge)	
Justification for the selection of the objectives	
Biodiversity strategy for 2030 is clearly structured in the following parts: 'Protecting Nature', 'Restoration of Nature', 'Enabling of transformative change', and 'The European Union for an ambitious global biodiversity agenda'.	
Sectoral impact estimate	
<p>The Biodiversity strategy for 2030 will have a significant positive impact on the environment in Europe. The achievement of policy objectives of 'The Biodiversity strategy for 2030' will result in improved and widened network of protected areas, reduced pollution emissions, restored freshwater ecosystems and the natural functions of river, implemented nature-based solutions and restored soil ecosystems. Nature-based solutions (e.g., restoring wetlands and coastal ecosystems, sustainably managing marine areas) will be vital for the climate adaptation. Moreover, technological innovations could support and fasten the restoration and protection of nature. The restoration of nature will contribute to the reduced pressure on habitats and species, climate change mitigation and improved ability to cope with future natural disasters. Protection and restoration of nature will have a significant economic benefit as it will generate return of investments (through nature-based tourism) and create new job opportunities (e.g., organic agriculture, renewable energy production). The shift to organic agriculture will have economic, environmental, and social impact as it will improve the quality of soils, decrease level of pollution from agriculture, create new jobs and provide more healthy and affordable food. Besides this, introducing of 'non-soil-bound' cultivation (e.g., hydroponics) could be considered as another way to shift to more sustainable agricultural practices with less impact on environment. Protecting and restoring biodiversity is key to prevent the emergence and spread of future diseases. Prevention of emergence and spread of future diseases, reduction of pollution and provision of more healthy and affordable food will positively influence physical and mental health and well-being.</p>	
Land use impact estimate	
Land use category	Anticipated impact
<i>Transport (incl. waterways)</i>	No impact
<i>Built-up area-Residential</i>	Restrictive
<i>Built-up area-Industrial area and offices</i>	Restrictive
<i>Agriculture-Greenhouses</i>	Expansive
<i>Agriculture-Other</i>	Expansive
<i>Woodland and nature</i>	Expansive



Limiting urban sprawl will result in restrictive effects on land use types <i>Built-up area-Residential</i> and <i>Built-up area-Industrial area and offices</i> . As a result of shifting to more sustainable agriculture practice, the anticipated impact on land use categories <i>Agriculture-Greenhouses</i> and <i>Agriculture-Other</i> is expansive. To succeed in restoring EU's biodiversity, especially in establishing a larger EU-wide network of protected areas on land and at sea, <i>Woodland and nature</i> land use type is expected to be expansive.	
Dependence estimate	
Strong political commitment is crucial for achieving goals defined by Biodiversity Strategy 2030. In addition, supportive financial mechanisms and solving the conflicts between conservation goals and other socio-economic objectives are important for achieving goals defined by the Strategy.	
Uncertainty estimate	
N/A	
Overall probability estimate	
0.69	In June 2021 the European Parliament adopted the EU Biodiversity strategy for 2030 therefore the necessary political ambition to achieve the objectives at the EU level is currently available (European Parliament 2021a). According to the EU Biodiversity strategy for 2030, EU proposed to provide minimum of EUR 20 billion per year for biodiversity through various sources (COM(2020) 380 final 2020). The success of the EU Biodiversity Strategy for 2030 in achieving its ambitious objectives will depend on the capacity of the EU Member States to plan strategically the implementation of conservation measures, better engage with general public and find a solution to potential conflicts with other socio-economic objectives and different sectoral policies. The better incorporation of biodiversity conservation into other sectoral policies and funding mechanisms will be crucial to overcome past weaknesses of EU's policies (Hermoso et al. 2022). It is highly likely for objective P3.1. (Protect nature), P3.3. (Enable transformative change) and P3.4. (EU for an ambitious global agenda) to be achieved as a result of political ambition and planned financial support. P3.2. is an objective that is moderately likely to be achieved due to its complexity and possible conflicts between biodiversity conservation and other sectoral interests.
FURTHER BACKGROUND INFORMATION	
The key aim of the EU's Biodiversity strategy for 2030 is to protect nature and reverse the degradation of ecosystems. This strategy fosters the resilience of our societies to future threats such as the impacts of climate change, forest fires, food insecurity and disease outbreaks. The four key pillars of the Strategy are: establishing a larger EU-wide network of protected areas on land and at sea, launching an EU nature restoration plan, introducing measures to enable the necessary transformative change and introducing measures to tackle the global biodiversity challenge (COM(2020) 380 final 2020).	
The achievement of most of the objectives is highly likely to occur as a result of political ambition and planned financial support. Objective P3.2. (Restore Nature) is the only objective that is moderately likely to be achieved due to its complexity and possible conflicts between biodiversity conservation and other sectoral interests.	



P4: Connecting Europe Facility	
Policy name	Connecting Europe Facility
Broader category	Economic
Policy area	Infrastructure
Method of delivery	Investment, grants, financial instruments
Time horizon	2030/2050
Main policy objectives	
P4.1. TEN-T: Completion of TEN-T Core network by 2030 and of TEN-T Comprehensive network by 2050	
P4.2. TEN-E: Establish a more interconnected, smarter, and digitalised TEN-E by removing bottlenecks and improving market integration (incl. cross-border) and thus contribute to main objectives of the EGD	
P4.3. TEN-Telecom: Improve digital connectivity and digital market in the EU through investment in digital infrastructure and broadband connectivity	
Justification for the selection of the objectives	
<p>The objectives follow the structure of the programme according to the main investment priorities and networks (TEN-T, TEN-E, TEN-Telecom). TEN-T is merged into one objective, despite the division between Core and Comprehensive networks. Secondary transport corridors in the Comprehensive networks may have different impacts on more isolated or less connected regions. Therefore, the investments in the core and comprehensive networks are happening in parallel and may have different effects on land use in more areas.</p>	
Sectoral impact estimate	
<p>The Connecting Europe Facility focuses on three main pillars of infrastructure, which also form the three main objectives. The first one (P4.1.) pertains to the completion of the TEN-T transport network (core and comprehensive). The second one (P4.2.) pertains to establishing a more interconnected, smarter, and digitalised TEN-E energy network by removing bottlenecks and improving market integration (incl. cross-border) and thus contribute to main objectives of the EGD. The third one (P4.3.) pertains to improving digital connectivity and digital market in the EU through investment in digital infrastructure and broadband connectivity.</p> <p>As a result of the achievement of the objectives, the energy security of the EU is improved, the energy policy becomes more an EU competence than member states' and completed projects are used to support political campaigns. Due to the increased investment in construction, new jobs are created in the sector. As a result of the completed transport projects, the connectivity between industrial centres and cities is improved and left-behind places are more connected. However, this can also create or form further left-behind places such as smaller and rural areas that remain not connected to the network. As a result, the competitiveness of SMEs in those areas as well as the competitiveness of metropolitan regions is improved. The investments in energy infrastructure result in better networks, better market conditions, safer supply of energy and potentially reduced prices. The investments in digital infrastructure result in improved conditions for the digital market. The investments in transport and digital infrastructure create more opportunities for jobs for people (either by making commuting easier or by working remotely). The connectivity to the Internet is improved and this may lead to stronger integration of digital and physical life. Overall, the improved infrastructure would result in more mobility by people and possibly a change in transport preferences to railway. The investments in energy may increase the number of cross-border energy communities. As a result of the above, the greenhouse gas emissions may increase initially, due to the increased construction activities, but fall in the long-term due to the expansion of the railway network and the change in transport preferences. However, the expanded network may result in more demand of energy and resources.</p>	



Land use impact estimate	
Land use category	Anticipated impact
<i>Transport (incl. waterways)</i>	Expansive
<i>Built-up area-Residential</i>	Expansive
<i>Built-up area-Industrial area and offices</i>	Inconclusive
<i>Agriculture-Greenhouses</i>	No impact
<i>Agriculture-Other</i>	Inconclusive
<i>Woodland and nature</i>	No impact
<p>The land use impacts of this policy imply an expansive effect on <i>Transport (incl. waterways)</i>. As a result, <i>Built-up area-Industrial area and offices</i> and <i>Built-up area-Residential</i> may also expand, especially along the main TEN-T corridors. At the same time in places that are not connected to the network, the negative effect on land use can be experienced in these two categories as investment and people may move to more connected places. Thus, the effects on <i>Built-up area-Residential</i> and <i>Built-up area-Industrial area and offices</i> are inconclusive as they differ depending on the place. The potential effects on <i>Agriculture-Other</i> are restrictive as more land may be allocated for energy projects. However, it is difficult to estimate the magnitude of this demand. No impact is anticipated on <i>Woodland and nature</i>.</p>	
Dependence estimate	
<p>The policy largely depends on financial resources allocation which, for the short term, have been approved. The digital aspect of the policy depends also on market dynamics and technological advancements, which are likely to occur without policy intervention from the EU.</p>	
Uncertainty estimate	
<p>Further escalation of the conflict between Russia and Ukraine and potential involvement of NATO/EU may shift priorities and decrease the investment in transport infrastructure.</p>	
Overall probability estimate	
0.72	<p>The short-term goals, in-line with the current MFF (2021-2027), are likely to be achieved and the networks will definitely be expanded to a large extent. The full completion, however, seems unlikely for either of the networks due to the higher cost and usual delays in major infrastructural projects.</p>
FURTHER BACKGROUND INFORMATION	
<p>The Connecting Europe Facility is one of the main financial instruments on delivering investments in key infrastructure for transport, energy, and digital connectivity. The programme is considered one of the key instruments on achieving the climate objectives of the EU (European Parliament 2021b) and is therefore viewed as a policy tool to achieving the objectives of the European Green Deal.⁴⁰ The programme is structured on three main pillars – CEF-Transport, CEF-Energy and CEF-Telecom. ±80% of the funding allocations are targeting investments in CEF-Transport, while 16% are targeting investments in CEF-Energy.</p> <p>The transport investments are planned according to an agreed detailed mapping of the Trans-European Network, developed for each type of transport. The network is divided in two groups – Core and Comprehensive network. The Core network is focused on key logistical nodes across member states, while the Comprehensive network encompasses secondary transport corridors leading to the Core network. Both networks are structured according to the main transport corridors of the EU (e.g., North Sea-Mediterranean, Rhine-Alpine). The TEN-T networks encompass transport infrastructure in the following types: Railways, Roads, Inland Waterways, Ports, Airports, Rail-Road Terminals. ±71% of the TEN-T budget allocation is targeted for Railway infrastructure (accounting to ±58% of the budget of the whole CEF) (European Commission 2022a). Objective P4.1., pertaining to the completion of the Core and Comprehensive transport networks is also time-bound to 2030 and 2050 respectively. Since the MFF for the current period has already been approved and most of the projects have already been</p>	

⁴⁰ https://cinea.ec.europa.eu/programmes/connecting-europe-facility/about-connecting-europe-facility_en



selected, it is fair to say that the Core network has a higher chance of success by 2030, although there are still risks due to the complexity of the projects and the usual delays in major infrastructural investments. The network is unequally distributed across countries also, which can present further challenges. The **CEF-Energy** stream targets investments in energy infrastructure with a specific focus on cross-border projects and synchronisation of the networks across member states. These investments are vital for the achievement of the Energy union and, respectively, the energy objectives of the EU in terms of the green transition. Respectively, the CEF-Energy targets the removal of bottlenecks within the energy infrastructure by identifying those as Projects of Common Interest. The different networks targeted are Smart Grids, CO₂, Gas and Electricity. They are also structured according to corridors going through member states. In light of the changing context on the continent following Russia's war on Ukraine, the investments in energy transition through CEF become strategic in order to achieve energy independence, specifically from Russia. The achievement of a **more interconnected network under CEF-Energy** is expected to result in market changes in the energy market. The investments under **CEF-Telecom** are related to the European Strategy for Smart, Sustainable and inclusive growth and the Digital Single Market, respectively. The investments focus on installing the necessary digital infrastructure for connectivity (Digital Service Infrastructures – DSI) and modernising the access and quality of broadband networks (CEF-Broadband under the CEF-Telecom stream). Respectively, the investments in CEF-Telecom contribute to improved internet accessibility of businesses, citizens, and institutions across member states, and, respectively, have impact on lifestyle. The effects of improved connectivity may contribute to better competitiveness between SMEs and businesses overall (especially in areas where the connectivity was missing or with bad quality), as well as more convenient options for citizens through digital services, thus avoiding traveling to obtain those. These investments contribute to the digital transition of the EU and may continue playing an important role in light of further advancements of internet connectivity, such as 6G and beyond (Akyildiz, Kak, and Nie 2020).



P5: Europe Fit for the Digital Age	
Policy name	Europe fit for the Digital Age
Broader category	Technological
Policy area	Economy
Method of delivery	Funding, Regulations, Strategies
Time horizon	2030
Main policy objectives	
P5.1. EU semiconductor leader: Double EU's global production capacity of semiconductor chips to 20% global share.	
P5.2. EU critical computing capacity: Develop EU's critical computing capacity in industry and R&D.	
P5.3. AI in agriculture: Increase the adoption of AI in agriculture through new instruments and data.	
P5.4. EU AI hub: Develop EU as a global hub for AI research and development for business, industry, and science.	
P5.5. EU strategic autonomy and the US: Strengthen EU's open strategic autonomy through improved supply of critical materials and closer cooperation in trade and strategic decisions with the USA.	
Justification for the selection of the objectives	
<p>The policy is cross-cutting and has implications beyond strict digital dimensions, mostly in different economic sectors. For some of the objectives, specific targets were set, most notably pertaining to the ambitions of the EU to become a global leader or improve its global market positioning (e.g., semiconductors). This objective has been included as it concerns key sectors and their expansion which has a higher likelihood to impact land use. Additionally, the objective on semiconductors has a geopolitical aspect in reference to the desired increased cooperation and trade with the USA, therefore this specific objective has also been included. The objectives pertaining to safe and accountable online environment and fair and open digital markets (Digital services act and Digital markets act) have been excluded as they are supportive of the management of the digital markets. The expansion of the digital market is also covered under the digitalisation trend together with digital public services (pertaining to European Digital Identity stream in this policy). AI is a cross-cutting topic across a few objectives under this policy – the objectives with higher economic relevance have been chosen (EU as an AI global hub, AI in agriculture). AI is only one of many digital aspects in healthcare, therefore this objective has been excluded as digitalisation in health is also covered under trend T3 (accelerated digitalisation). The security dimension of the policy has been included as part of the objective on EU's open strategic autonomy, grouped with the objective on securing the supply of critical raw materials in cooperation with the US. Cybersecurity elements (related to digital advancements in European Defense) have been also considered under the objective of critical computing capacity expansion. Space dimension of the policy has been excluded as it pertains to investments in space resources, satellites, and traffic.</p>	
Sectoral impact estimate	
<p>The objectives of the policy are referring to advancements in key industries and their digitalisation. A specific objective for the doubling of the semiconductor industry is defined. The policy also includes an objective pertaining to the development of critical computing capacity in industry and R&D. An objective is placed on the adoption of AI in agriculture in the context of another specific objective on developing AI and turning the EU in a global AI hub. Lastly, an objective is placed on improving the strategic autonomy of the EU in coordination with the US, including in the context of supplying critical materials.</p> <p>The strategic emphasis on critical computing capacity can result in more political support for the construction of key locations such as supercomputers and servers. The increased importance of this infrastructure can increase the vulnerability of governments and business as they can be more susceptible to cyberattacks. From economic perspective, the trend can result in overall increase of investments and employment in semiconductor (and supporting) industry (double if the objective is fully achieved), as well as further expansion of IT industry. In addition, the increased investments by the US can further strengthen this sector, as well as other sectors, such as the processing and supply of critical materials. The adoption of AI in SMEs and agriculture can improve the competitiveness of both sectors. The AI adoption in</p>	



agriculture can make this sector more competitive, especially in agricultural-rural areas. The increased investments in technology and the respective expansion of this industry can lead to further migration processes to already developed centres. Furthermore, external migration (from outside of the EU) can increase to these centres at the expense of outmigration from less developed regions and countries. The further expansion of the technology sector can lead to a decrease in economic activity in other sectors first, respectively loss of jobs. However, after a transition period it can be expected that more people may be employed in the technology industry. The utilisation of AI in agriculture can result in optimisation of agricultural production and, respectively, less pollution and improved biodiversity in natural areas. The increased higher demand for servers and critical computing capacity can result in higher electricity demand as well as higher carbon footprint from these locations. From technological perspective, new breakthroughs can be expected.

Land use impact estimate	
Land use category	Anticipated impact
<i>Transport (incl. waterways)</i>	No impact
<i>Built-up area-Residential</i>	Expansive
<i>Built-up area-Industrial area and offices</i>	Expansive
<i>Agriculture-Greenhouses</i>	No impact
<i>Agriculture-Other</i>	Restrictive
<i>Woodland and nature</i>	Restrictive

The land use effects of the above can result in expansive effects of industrial areas (*Built-up area-Industrial area and offices*), especially in already developed places, also specifically for the semiconductor industry. The increased migration as a result of that can also lead to expansive effects on *Built-up area-Residential* in those places. The reverse effect can be anticipated in less developed regions – negative land use in those two categories. The location of the critical computing capacity can put pressure on agricultural or natural areas with restrictive effects (*Agriculture-Other* and *Woodland and nature*) as they may need to be built on natural land with lower climate risks.

Dependence estimate

Despite being a policy priority, objectives P5.1. (EU semiconductor leader) and P5.2. (EU critical computing capacity) depend also on the market. The policy may create favourable conditions, but it does not aim to control the market fully. The AI objectives ultimately depend on technological advancements. The last objective on the US depends on political factors and has a geopolitical dimension.

Uncertainty estimate

Further escalation of the conflict between Russia and Ukraine can shift the priorities in terms of industrial production and deprioritise the policy. Unexpected disruptions in supply chain globally can impede the expected growth (e.g., pandemic, or other global crises). In case of a political change in the US (e.g., Donald Trump being re-elected), objective P5.5. (EU strategic autonomy and US) can be affected. In case another global bloc gains the competitive advantage in the critical industries and supply chains, such as semiconductors, this may decrease the chances of achieving objective P5.1. (EU semiconductor leader) (this hypothesis is developed in trend element T4.1. with USA and China becoming leaders). A positive effect can occur in case a technological breakthrough (quantum chips or next-gen semiconductors) speeds up the increase of capacity in industrial production.

Overall probability estimate

0.42	Objective P5.1. (EU semiconductor leader) is the most likely to occur as actions are already being taken in this regard and legislation has been voted by the EP. At the same time negotiations with US are ongoing and semiconductors are a political priority at the highest level. AI in business is advancing on its own, thus its adoption probability is quite high, but without anticipated land use impact. Objectives P5.2. (EU critical computing capacity) and P5.3. (AI in agriculture) are with a lower probability or may take a longer time.
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FURTHER BACKGROUND INFORMATION

"A Europe fit for the Digital Age" is one of the main priorities of the EU and supports the digital aspect of the twin transition (along with the green one). One of the main objectives of the policy is P5.1. **increase of Europe's share in global semiconductor (chips) production** to 20%⁴¹ (currently 10%) (JRC 2022) and overall to increase the competitiveness and resilience in semiconductor technologies. This priority has been iterated on highest political level (von der Leyen 2020) and remains in the agenda of the Council of the EU in light of EU's efforts to achieve strategic autonomy, improve competitiveness and introduce reindustrialisation, especially for critical materials (Government of Spain 2023). The EU is allocating a significant financial package for this objective. The proposed legislation to facilitate this policy priority has already been approved by the EP and is expected to reach negotiations with member states⁴² (European Commission 2022b, 2022a). This objective has a geostrategic component and is related to the cooperation with the USA in the field of semiconductors and critical raw materials (Chatham House 2023), also envisioned as part of the policy. This tendency can be further supported by the achievement of the objective P5.5. on the **cooperation with the USA in critical industrial sectors**⁴³ as well as the supply of critical materials globally (European Commission 2020b, 2020a). The achievement of these two objectives may result in further strengthening existing urban and industrial centres, thus triggering further migration to those (hence draining less developed regions). Objective P5.2. on **developing critical computing capacity**, specifically data servers, may give impetus to industry and research in the area and result in building new data and cloud centres in the EU, potentially in key locations with low risks of natural disasters and stable climate due to the specific requirements for locations of data centres, as well as to increase demand of electricity and produce high carbon emissions (The MIT Press Reader 2022). Objective P5.4. on **AI** priority of the policy focuses on adoption of AI in business and science, including as a leading research priority. A specific attention is paid to the utilisation of **AI in agriculture** (objective P5.3.) which can improve efficiency of farms, as well as environmental and economic sustainability (Columbus 2021). The EU is already working on adopting big data and AI in agriculture.⁴⁴ Additionally, a coordinated plan on the adoption of AI is underway (European Commission 2021). The effects of adoption of AI in agriculture can make the production more efficient within the existing land use limits.

⁴¹ https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-chips-act_en

⁴² <https://www.europarl.europa.eu/news/en/headlines/society/20230210STO74502/chips-act-the-eu-s-plan-to-overcome-semiconductor-shortage>

⁴³ https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/stronger-europe-world/eu-us-trade-and-technology-council_en

⁴⁴ <https://digital-strategy.ec.europa.eu/en/library/common-european-data-spaces-agriculture-and-mobility>



T1: Increasing shift to renewables	
Trend name	Increasing shift to renewables
Broader category	Environmental
Policy area	Energy
Method of delivery	Strategic documents, investments in research and development, investments in infrastructure
Time horizon	2030
Main trend elements	
T1.1. Need for renewable energy: Growing need for renewable energy.	
T1.2. Policy for renewables: Policy support for achieving shift to renewables.	
T1.3. Research on renewables: Increase of research and development in renewable energy technology.	
T1.4. Awareness of renewables: Raising public awareness and involvement of public in shift to renewables.	
T1.5. Investment and jobs in renewables: Increasing investment in renewable energy production and need for skilled workers.	
Justification for the selection of trend elements	
The main elements of the trend 'Increasing shift to renewables' are 'Growing need for renewable energy', 'Policy support for achieving shift to renewable energy', 'Increase of research and development in renewable energy technology', 'Raising public awareness and involvement of public in shift to renewables' and 'Increasing investment in renewable energy production and need for skilled workers'. These encompass various perspectives of the trend in terms of energy consumption, further development of technology, consumer behaviour shifts and labour market.	
Sectoral impact estimate	
The trend will influence development of policies that reinforce and regulate use of renewables and increase of governments' investments in research and development of renewables. The shift supported by the policies and investments will result in increased energy independence and security and in international cooperation on research and development in renewable energy technology. Shifting to renewables will have a positive impact on environment by reducing greenhouse gas emissions and reduced pollution that will lead to recovery of biodiversity, contribution to attempts to limiting the long-term increase in average global temperature to 1.5°C and climate change mitigation. To achieve the energy transition goals more investments in technological innovation will be needed. Technological innovation will cause wider deployment of new technologies as a result of new energy storage, transmission and distribution technologies. When it comes to employment, energy transition will cause creation of new jobs that will be accompanied with increased shortage of skilled labour force needed. Further development of renewable energy technologies will result in reduction of costs of renewables. Increased involvement of citizens in energy transition and increased cost savings for households that use renewable energy will encourage people to use renewables in everyday life. Also, the improvement of environmental aspect will positively influence the health of people and quality of life.	
Land use impact estimate	
Land use category	Anticipated impact
<i>Transport (incl. waterways)</i>	No impact
<i>Built-up area-Residential</i>	Expansive
<i>Built-up area-Industrial area and offices</i>	Expansive
<i>Agriculture-Greenhouses</i>	No impact
<i>Agriculture-Other</i>	Restrictive
<i>Woodland and nature</i>	Restrictive



The trend 'Increasing shift to renewables' will significantly influence land-use patterns. The land use types *Woodland and nature* and *Agriculture-other* may be restricted, while land use types *Built-up area-Residential* and *Built-up area-Industrial area and offices* may need to be extended to provide area for implementation of new renewable energy infrastructure. However, there is a possibility to use existing area (e.g. existing industrial sites, rooftops) for introducing new renewable energy infrastructure and this could mean that the land use impact on *Built-up area-Residential* and *Built-up area-industrial area and offices* land use types could be different depending on the area where it is located (e.g. urban or rural area) and the scale of the renewable energy investment (e.g. household energy provisioning with small scale solutions vs. large scale solar or wind farms, for instance).

Dependence estimate

Several global crises highlight the pressing need to accelerate the global energy transition. Shift to renewables will depend highly on policy and regulatory measures and international co-operative flows of financial assistance and knowledge. Research and development play a key role in reducing costs, improving reliability, and making renewable energy accessible for various applications. A comprehensive and integrated policy framework that addresses the most significant barriers to deployment such as raising public awareness is needed (IRENA 2022).

Uncertainty estimate

N/A

Overall probability estimate

0.98

Political commitment at the EU level is crucial for increasing the shift to renewables. The Renewable Energy Directive, European Green Deal and REPowerEU are supporting the shift to the increased use of renewables. As it is clear that EU has a strong ambition to accelerate the take-up of renewables by 2030, it is highly likely that the trend consequences will occur.

FURTHER BACKGROUND INFORMATION

The energy sector is responsible for more than 75% of the EU's greenhouse gas emissions. The increased share of renewable energy is a key element to reach EU's energy and climate objectives (European Commission 2019). The past years have showed weaknesses and vulnerabilities of a system heavily reliant on the fossil fuels. Shift to renewable energy could improve economic resilience and energy security of countries. Moreover, energy transition will create many new jobs (IRENA 2022). Transition to renewables is the most realistic way to avoid the worst effects of climate change (International Energy Agency 2021). Transition to renewable energy will be a driver of land use change due to the shift away from energy stored in the lithosphere (fossil fuels) to energy in the biosphere (renewables) (Han Tran and Egermann 2022).



T2: Working from anywhere	
Trend name	Working from anywhere
Broader category	Economic
Policy area	Labour
Method of delivery	Political and administrative decisions, social trends, market and workflow development
Time horizon	2030
Main trend elements	
T2.1. Flexible work arrangements: Work arrangements become more flexible (domestic remote working/hybrid solutions).	
T2.2. Cross-border remote working: Increase of cross-border remote working from one determined place (freedom of labour in the EU).	
T2.3. Digital nomadism: Digital nomadism (working while travelling) and freelancing become more popular.	
T2.4. New work regulations: New tax and social security regimes in the EU to accommodate changing working habits.	
T2.5. Social division: Increasing societal polarisation between those you can work remotely and those who cannot.	
Justification for the selection of trend elements	
The trend elements are mostly influenced by the observations during the Covid-19 pandemic which gave a strong boost to remote working. In addition, EU specific considerations, such as cross-border labour, have been taken into account, together with the hypothesis of digital divide as manifested in labour terms in reference to the trend.	
Sectoral impact estimate	
Politically, all trend elements lead to an increase and strengthening of EU regulations as well as new tax and social security schemes to facilitate remote working but especially cross-border employment. Despite EU-wide regulations, bilateral agreements will develop to enable cross-border labour market interaction on local and regional level. Politically but also economically, markets become more vulnerable for cyber-attacks.	
The economic sector will experience immediate and secondary impacts. First, more companies and sectors will assess the feasibility of employees working remotely which e.g., got accelerated by the Covid-19 pandemic and the obligation to allow for remote working as far as possible. These adjustments require adapted processes in workflow and administration, entailing a transition phase of economic recession due to initial reduction of productivity and additional required resources. After that, the productivity of employees is likely to increase and the need for less office space reduces costs for companies. However, this also means lower demand for services around office management and a loss of jobs in e.g., maintenance and office supply branches. The possibility of hiring people from countries with lower income decreases staff costs and gives sectors in which remote work is possible a further advantage compared to those, where it is impossible such as manufacturing, transport, or construction. Further new forms of employment develop including more flexible in time management and location. The possibility of living and thus spending money in a different region, country or even continent than it is earned will increase the disparities of the economic performance e.g., between more and less attractive countries regarding residence and tax paying.	
These geographical disparities also enhance social inequality e.g., in countries where people move with a high income from their country of employment. This could lead to overcrowding of certain attractive regions and countries and overstraining public and social services as well as transport and housing infrastructure, putting pressure on lower income groups. In addition, social injustice is also further	



enhanced through the immediate impacts like not everyone being able to work from anywhere, the shift of certain responsibilities and costs from employer to employee, not everyone having appropriate environments e.g., at home for fulfilling office functions. For some people, social isolation can also lead to depression and other mental health issues. For others, however, increased flexibility, the ability to work from the favoured location and reduced need for commuting leads to less stress, better health and a general improvement of life quality. This of course only accounts for people who are able to work remotely, implying that this trend has rather ambiguous social impacts. Less commuting will on the one hand lead to a decrease in demand and thus minimised offer in public transport, meaning that rural areas are less connected and get left behind. On the other hand, people are more likely to move to the countryside, resulting in a decline of sub-urban areas and shifting housing and transport patterns to more polycentric schemes. This implies, that transport use is neither reduced nor expanded but the behaviour changes.

This also influences the environmental sector. Less commuting generally leads to reduced emissions and less pollutions. However, the impact of reduced short distance commuting and higher demand for less frequent but longer commutes cannot be estimated.

The technological sector will experience investments and thus innovation in e.g., online communication and project management tools as well as a high demand for cyber security and data protection measures.

Land use impact estimate	
Land use category	Anticipated impact
<i>Transport (incl. waterways)</i>	Inconclusive
<i>Built-up area-Residential</i>	Expansive
<i>Built-up area-Industrial area and offices</i>	Restrictive
<i>Agriculture-Greenhouses</i>	No impact
<i>Agriculture-Other</i>	No impact
<i>Woodland and nature</i>	No impact

Transport (incl. waterways) would also be used differently, but since commuting is not eliminated completely (at least for the temporary forms of remote working), the infrastructure is likely to remain. Lower frequency of commuting, however, enables people to have higher distance between the office and residence, taking pressure off densely populated areas and enabling urban sprawl. Therefore, the impact is inconclusive. All trend elements mostly impact the *Built-up area-Industrial area and offices* by restricting this form of land use due to reduced need for office spaces. The geographical differentiation between work and living is strongly increased. This leads to a geographical re-distribution within the EU: concentration of employment in countries and specifically cities with high wages and low taxes as well as concentration of regions with high living quality but low living expenses. The impact on *Built-up area-Residential* is expansive since more people use their homes as an office and move to larger places in the countryside.

Dependence estimate

T2.1. (Flexible work arrangements): It is mostly dependent on the adaptability and willingness of companies to provide remote working options for their employees, however it strongly depends on the sector as not all sectors are suitable for remote working. T2.2. (Cross-border remote working): the cross-border working mobility is more depending on the political sector since agreements between countries or within the EU determine how feasible it is for companies to allow cross-border remote working. T2.3. (Digital nomadism): Political decisions and regulations are also decisive for the development of digital nomadism, however it depends more on company structures, as well as industries, processes, and workflows if that kind of remote working is even possible or desirable for the business.

Uncertainty estimate

Another pandemic or a global event that disrupts travel patterns can have a further positive reinforcing effect on this trend and actually increase its effects.



Overall probability estimate	
0.57	<p>T2.1. (Flexible work arrangements): Since the pandemic, these soft remote working solutions have become common, and there is an increased demand on the employment market and among employees. It is likely that such solutions become even more established in different sectors and less dynamic businesses. T2.2. (Cross-border remote working): Due to administrative/bureaucratic obstacles and regulations limiting cross-border remote working, this trend element is less likely to occur, at least as a dominating form of employment. It is more likely to be limited to a certain number of days and a certain type of office jobs, although even this is not yet possible between all MS in the EU. T2.3. (Digital nomadism): the working from anywhere in the world trend, enhanced through the employment form of freelancing is becoming more popular. However, this is also limited due to either national or company policies. Since it cannot be applied for many sectors, the context depicts a lower probability.</p>
FURTHER BACKGROUND INFORMATION	
<p>Latest since the Covid-19 pandemic, working from home or working from anywhere has become relevant on the labour market and the pandemic has triggered an acceleration of change and dynamics (Prithwiraj (Raj) Choudhury 2020). Since then, many new models, solutions and types of remote working have developed or adapted and changed the dynamics of working (Anon 2022; KPMG International 2022). Therefore, three different forms of remote working were analysed in this trend. They represent increasing intensities, physical distances and duration of working remotely, showing various sectoral impact. The trend of Working from Anywhere is likely to develop in different extent, depending on the form and regulations for working from abroad and it varies significantly among the different sectors, since industrial production e.g., does not allow for working remotely at all. However, the opportunity to work remotely has become a standard for many employees which also shapes the labour market and is likely to become more relevant (Baskin 2022; Joint Research Centre 2022). The different forms of remote working have different sectoral impacts, but all limit the demand for office space due to the shift to working from home or increased working mobility.</p>	



T3: Accelerated digitalisation and omnichannel futures	
Trend name	Accelerated digitalization and omnichannel futures
Broader category	Technological
Policy area	Technology
Method of delivery	New business models, market shifts and adoption of technological tools in existing areas
Time horizon	2030
Main trend elements	
T3.1. Technology in health: Wider adoption of technology for prevention, monitoring, consultation, and treatment in health	
T3.2. Technology in education: Wider adoption of digital solutions for education (incl. remote education)	
T3.3. Digital alternatives: Wider adoption of digital alternatives to physical reality (incl. immersive technology, AR/VR)	
T3.4. Online trade expansion: Further expansion of online trade and parallel/converging commercial activity offline and online	
Justification for the selection of trend elements	
The identified trend elements pertain to wider adoption of technology in health; wider adoption of technology in education; the increased usage of alternatives to physical reality (such as AR and VR); and the expansion of the online trade in parallel to convergence with offline one. The trend is viewed from a global perspective.	
Sectoral impact estimate	
The wider adoption of technology in education and health can be supported by increased public investment in those areas. At the same time, advancements in big data in education and health can support better and more targeted policies in those areas. The further expansion of online trade can trigger further regulations to this type of trade in addition to overall efforts from the public sector to regulate all digital and online activities (e.g., EP has recently adopted measures on regulations and transparency on crypto markets ⁴⁵). From economic perspective, the ed-tech and health-tech industries can expand. The online markets can expand further thanks to the increase in online sales. More job opportunities can emerge for online jobs while a decline in more traditional “offline” labour may be expected at first, before the market adapts to the further influence of online and digital. Furthermore, the adoption of technologies in business can result in labour optimisation which may lead to adjustments in the labour market whereas some jobs are lost but others are adapted to the new technologies. A parallel online market can advance further but be volatile due to speculations in cryptocurrency and overall instability. As a result of the advancement in technology, education and health can become more accessible and people would travel less to obtain those services. In addition, people will be able to spend more time at home for entertainment and recreation, due to the advancements in this area. The continuous increase of online trade can minimise offline commercial activity. As a result of the increasing dependence on online resources, people without access to Internet may be further excluded (digital divide). From environmental perspective, the increase in online trade may result in increased pressure on cargo shipments. The additional demand for online space may lead to increased demand for server space and associated emissions with this. At the same time, due to the lower need for travelling, the emissions from this sector can decrease. From technological perspective, new solutions for health monitoring and treatment, including remotely, can be developed, as well as in education. Furthermore, innovation in immersive technology can develop.	

⁴⁵ <https://www.europarl.europa.eu/news/en/press-room/20230414IPR80133/crypto-assets-green-light-to-new-rules-for-tracing-transfers-in-the-eu>



Land use impact estimate	
Land use category	Anticipated impact
<i>Transport (incl. waterways)</i>	Restrictive
<i>Built-up area-Residential</i>	Expansive
<i>Built-up area-Industrial area and offices</i>	Expansive
<i>Agriculture-Greenhouses</i>	No impact
<i>Agriculture-Other</i>	No impact
<i>Woodland and nature</i>	No impact
<p>The increased digital accessibility of services can reduce the demand for travel and pressure on transport, and, respectively <i>Transport (incl. waterways)</i> land use type may decrease. The more time spent home can result in increased pressure on residential areas (<i>Built-up area-Residential</i>). The land use impact from the technological advancements in health and education can be associated with the expansion of healthcare and technological industries (<i>Built-up area-Industrial area and offices</i>) and a decrease of the need for office space due to more remote jobs. Further pressure can be expected on ports due to increases in online trade (<i>Built-up area-Industrial area and offices</i>). The increased online commercial activity can decrease the demand for commercial land use (land use type not captured). There might be associated increase of land use need for servers, and respectively in land use <i>Woodland and nature</i>, due to their specific location requirements.</p>	
Dependence estimate	
<p>Due to the relative independence and self-perpetuation of technology and IT sector, this trend is moving at a higher speed and mostly depends on innovation and continuous technological advancement. Technology is often closely tied with market, therefore the trend is complemented by economic activity dependence. As private capital is usually the driving force behind technology and IT and technology evolution usually has a disruptive effect a continuous effort in regulation can be expected.</p>	
Uncertainty estimate	
<p>Negative effects of the early adoption of replacement technology in health (e.g., misdiagnosis) can delay the trend element significantly as healthcare changes are slower to implement due to ethical concerns. Health data leaks or monopolisation activities by private actors may jeopardise the occurrence of the trend. A commercial private initiative to monopolise online knowledge by creating a mega platform can kick off public investment and initiate a race in this aspect, thus increase options.</p>	
Overall probability estimate	
0.74	<p>The digitalisation trends in health and education are already under way, especially after the Covid-19 pandemic. There are already market forecasts on their potential and to a certain extent it can be said that these trend elements are irreversible. The digital alternatives to physical reality are expected to be the next phase of the Internet (Web 3.0.) and are generally also expected to materialise, however, due to the volatility of the market dimension of this trend (cryptocurrency) and the relatively slow adoption as of today, the probability is moderate but still highly possible, although perhaps with a delay. Online commercial activity is already a widely normalised phenomenon, however, due to its global nature, it is more susceptible to global disruptions and geopolitical factors. In light of the formation of a multipolar world the speed and breadth of this trend may be lower than expected. The main wild cards to this trend pertain to misuse and leakage of data, especially for the health sphere, as well as to the tension between private and public initiatives whereas private capital usually has the upper hand and can trigger ripple effects as a result of a major commercial decision.</p>
FURTHER BACKGROUND INFORMATION	
<p>The global trend of accelerated digitalisation and omnichannel futures encompasses the penetration of technology in different fields and its impact on the lives of people. As the last few decades have shown,</p>	



technology has a disruptive power and is capable of reinventing the way we work, get entertainment, travel, among others. Technology has also become a significant factor in economy as well as by expanding further the IT industry and its accompanying ecosystem. Therefore, this global trend captures the penetration of technology in key fields and industries through new business models, market shifts and increased “technologisation” of life.

The utilisation of technology in medicine and healthcare has always accompanied the advancements in those fields. Apart from the development of advanced technologies to facilitate the work of medical professionals, the more relevant aspect of the digitalisation of healthcare is the **wider adoption of e-health technology for prevention, monitoring, treatment, and consultation**. The global digital health market has been forecasted to expand significantly in the next 10 years and reach US\$ 551.1 bn by 2027 (Precedence Research 2022). This aspect particularly refers to citizens utilising wearable technology or apps and portals to continuously monitor their health and wellbeing. This aspect of the trend is currently expanding and the market for such solutions has increased with over 30% in 2021 as compared to the previous year.⁴⁶ Following the COVID-19 pandemic, telemedicine has become an increasingly acceptable way of receiving healthcare. Apart from data privacy concerns, shared by 30% of consumers of digital health (Accenture 2021), digital health tech is on the rise.

In a similar way, **adoption of digital technologies in education** has been on the rise, especially since the COVID-19 pandemic. Apart from the utilisation of tech tools in classrooms (e.g., AR and VR), **remote education** (in different forms) becomes an ever-increasing phenomenon, especially in the context of democratisation of knowledge. The global e-learning market is expected to reach \$457.8 billion⁴⁷ and thus further proliferate the options for digital platforms of education and continuous production of educational content. The creation of platforms or the utilisation of social media (with the newest trend of microlearning – very short videos with bits of information) for educational purposes ultimately results in knowledge and information accessible to anyone with access to the Internet while at the same time challenging the traditional ways of obtaining formal education. Furthermore, the expansion of this trend and its market share result in new professions such as digital creator-educators (Thinkific 2023). The global expansion of ed-tech contributes to overcoming educational inequalities by making knowledge widely accessible and also personalised, due to the wider variety of choices of content. At the same time, this can create a digital divide whereas the widely accessible educational content is of lower quality but the more advanced one is accessible only for privileged groups. This trend element can ultimately question the role of formal education or transform it into a hybrid version, including a digital/remote delivery of education, thus minimising the need to travel or to physically attend institutionalised education (Newman 2017)(Marr 2022). As a side effect, however, this can lead to diminished ability to critically evaluate the information received and, respectively, higher susceptibility of people to manipulation.

Digital alternatives to our current physical reality are expected to expand further and affect businesses and lifestyle globally. With the expected rise of Web 3.0. and the advancement of technology for immersive and virtual experiences, together with the wider adoption of AI and further technological advancements, businesses, and the way of working in many industries is expected to revolutionise even further, beyond the adaptation to more online working as a result of the Covid-19 pandemic. With the wider adoption of digital engagement, extended reality, cloud platforms and overall optimisation and modernisation, citizens will have access to a variety of options to work and get entertainment digitally (Deloitte 2023). The advancement in those areas is expected to result in the next phase of the internet, Web 3.0, namely, the metaverse. It is unclear how long it is going to take to reach a more advanced version of this technological trend, however, the overall direction of convergence between physical and virtual worlds is agreed

⁴⁶ www.jabil.com/blog/connected-health-technology-trends.html

⁴⁷ <https://www.globenewswire.com/news-release/2021/07/13/2262081/0/en/Global-E-Learning-Market-to-Reach-457-8-Billion-by-2026.html>



upon(Copenhagen Institute for Futures Studies 2023). As a result, it is expected that the way we work, play or travel may shift to a virtual version, thus increasing the time spent at home and minimising traveling.

Lastly, the strictly **commercial aspect of digitalisation** which is already widely adopted – **online sales and shopping** – is expected to expand further. With improvements in the areas of optimisation of sales, introducing a more experiential dimension to online shopping and overall global dimension of this market (Worldpay 2019), it is expected that online and offline sales will also converge and become seamless.



T4: Geostrategic plans of others	
Trend name	Geostrategic plans of others (outside of Europe)
Broader category	Political
Policy area	Politics/Geopolitics
Method of delivery	Strategic geopolitical decisions, investments, military interventions
Time horizon	2050
Main trend elements	
T4.1. US and China tech supremacy: US and China continue international trade race, incl. in semiconductor industry, and sidetrack EU.	
T4.2. China and Russia influence: China shifts focus of external investments and influence to Middle East, Caucasus, Central Asia and Africa in alignment with Russia.	
T4.3. India-Pakistan conflict: Escalation of conflict between India and Pakistan in Kashmir.	
T4.4. US-Iran confrontation: US engages in military intervention in Iran to achieve regime change.	
T4.5. QUAD cooperation: QUAD (Australia, India, Japan, USA) establishes control over the Indo-Pacific region (instead of China).	
Justification for the selection of trend elements	
<p>The trend encompasses five potential hypotheses of internationally relevant developments outside of Europe that can still have influence on the EU should they occur. The trend includes an increased protectionist policy of the US and China in the context of their increasing competition (especially for the semiconductor, tech and raw materials industries); the increasing influence of China (and Russia) on developing countries, especially in Africa, as part of the challenging of the established international order; an escalation of the conflict between India and Pakistan; US military intervention in Iran; increased cooperation between QUAD (Indo-Pacific region) and the West, including the EU. The trend selects geostrategic regions, countries and topics that may have impact in the future. China and US are more prominent due to their stronger influence globally, India as an emerging global power, Middle East proxy (Iran), QUAD because of its strategic importance between US/Western world and China.</p>	
Sectoral impact estimate	
<p>The increasing influence of China and Russia can diminish EU's influence in Africa and lead to further destabilisation of the region. The possibility of military conflicts may trigger increased public spending in defence as well as put pressure on social spending due to the possibility of increased migration. The latter can also be complemented by increased number of policies and debates on managing migration on European and national level. The decrease of investment activity by the US in the EU, especially in key industries, may lead to a slowdown from FDI-driven growth, but after a transition period it may increase the competitiveness of the EU internally. These investments can be potentially compensated by the possible increased cooperation with QUAD. As a result, economic activity can still expand, especially in established regions and cities. Socially, apart from the privacy concerns of using Chinese technology, a significant increase of migration pressure can occur. This can be two-fold in terms of involuntary migration from conflict-torn regions (e.g., Africa, Middle East, India-Pakistan) and in terms of voluntary migration in terms of improved cooperation between the EU and other regions (e.g., QUAD). This can lead to further challenges in terms of service provisioning, housing, and assistance as well as in terms of social cohesion from integration perspective. The voluntary migration can also increase from the EU to other global regions as the economic cooperation advances. From environmental perspective, emissions from cargo shipments may remain stable in the hypothesis of decreased flows between the US and EU and increase of flows between EU and QUAD. Technological innovations may be developed in light of the increased military spending.</p>	



Land use impact estimate	
Land use category	Anticipated impact
<i>Transport (incl. waterways)</i>	No impact
<i>Built-up area-Residential</i>	Expansive
<i>Built-up area-Industrial area and offices</i>	Expansive
<i>Agriculture-Greenhouses</i>	No impact
<i>Agriculture-Other</i>	No impact
<i>Woodland and nature</i>	No impact
<p>The potential land use effects of the above consequences may result in more demand for industrial land use – expansive <i>Built-up area-Industrial area and offices</i>, especially in established industrial and economic centres. Potential further expansion of <i>Built-up area-Industrial area and offices</i> can be anticipated as a result of more military spending. The most significant potential increase can occur in <i>Built-up area-Residential</i> whereas the potential multiple trigger points for involuntary migration may trigger too high demand for refugee housing and subsequent long-term housing. This can be further aggravated by the increased demand for housing in established urban centres as a double effect by the potential two types of migration waves. Combined with challenged public budgets this can put further pressure on the housing market to respond to these changes and trigger housing prices increase.</p>	
Dependence estimate	
<p>The trend is dependent on various political decisions in specific countries and global regions. From current perspective, it is also dependent on the development of the war of Russia on Ukraine as a proxy between the West and the East (or in the context of multipolar world). Even strictly economic strategic interests, such as the semiconductor industry, are influenced by geopolitical considerations at the current moment.</p>	
Uncertainty estimate	
<p>A negative risk factor for the trend is a potential eruption of another military conflict point, such as Israel-Iran clash.</p>	
Overall probability estimate	
0.55	<p>The conflict between Russia and Ukraine has opened a renewed discussion on the global security landscape. Respectively, every move by a country or a group of countries is now viewed in this new shifting context. The unpredictability of major forces, such as Russia, creates an overall unstable international environment where every decision matters. Still, the debate on these new dynamics remains cautious and restrained, despite provocations. This creates a lower likelihood of further escalation, especially in some regions. However, the wild card possibility is higher, due to the unpredictability of behaviour of political leaders in some countries and the potential of those to trigger major global effects.</p>
FURTHER BACKGROUND INFORMATION	
<p>The premises of this trend are based on the idea of a multipolar world (as opposed to East-West division such as the Cold War). Respectively, due to the multipolarity, the trend elements represent potential internationally relevant developments in key regions of the world (outside of Europe) or geopolitical interests that can have influence on the world, and the EU respectively. The effects are anticipated from EU perspective. Due to the diversity of the trend elements, pertaining to specific decisions or possibilities in different parts of the world, it is recommended that this impact estimate is viewed separately for each trend element, despite the possibility of overlaps between some of them.</p> <p>The competition between USA and China, especially in the technological sector, remains a key issue for both countries. The US is expected to pursue a strategy that increases its competitiveness on national level and, internationally, to compete specifically with China and in the technological sector (The White House 2022). The economic strength of China is viewed as a lever of influence on global world order, including politically, and the US would attempt to counteract that. This strategic focus of the US aligns with</p>	



the geopolitical shifts towards “economic security” and economic self-sufficiency and potential decoupling from China (E&Y 2022) in the West, but the need to outcompete China, and thus to disrupt interdependence from it, may result in misalignment in the West (Aspen Strategy Group, Mercator Institute for China Studies, and Munich Security Conference 2023). China’s economic priorities also shift to boosting internal consumption to achieve growth and compensate the effects of the continuous responses to the pandemic.⁴⁸ In line with party policy, the country is pursuing the goal of becoming a global cyberpower, including with its approach of utilising technology for state control.⁴⁹ The semiconductor industry is a key factor in this international competition with both countries focusing on expanding their strategic capacity to produce and supply **semiconductors**.⁵⁰ These investments are in-line with the overall tendency of hardening of technology blocs on global level (E&Y 2022).

China has also been pursuing further international influence through increased investment in infrastructure in specific countries, including through the Belt and Road Initiative – a massive programme of state investment in infrastructure in countries in Asia and Europe. As a result, it has managed to enter key European markets on construction. Its influence has already triggered questions and, especially since the beginning of the Russian war on Ukraine and China’s controversial position towards it. The latter has overall deteriorated the relationship with the EU (Morgan Stanley 2022). Respectively, the EU has attempted to push back or strategically address Chinese involvement in member states and enlargement areas as a matter of security (European Court of Auditors 2020). At the same time, due to the disruptions following the pandemic, the possibility of minimising Chinese investments in the EU is more likely as China attempts to focus on its internal market (Gong 2023). Furthermore, the EU is attempting to create distance from China in light of its ambiguous position towards the Russian war on Ukraine. Thus, the EU is in-line with the overall tendency of a more multipolar world.⁵¹ **China**, however, maintains its interest in certain world regions, notably Africa, where its investments are creating long-term debt dependence of fragile governments in an overall unstable region.⁵² Africa is the region where Russian influence is also stable and continuously growing, especially in terms of mining projects or even weapon supply.⁵³ The focus of the two countries on the continent is as a result of the withdrawal of Western investment and involvement there⁵⁴, thus it may trigger further instability and form as a new centre of influence in a multipolar world and serve as an attempt for Russia and China to advance their political agenda in terms of geopolitical balance. In light of the Russian war on Ukraine, the post-World War II world order is put into question and many fear that Russia and China are attempting to achieve not only a multipolar world, but to reform completely the international cooperation in a more authoritarian direction and against the main principles currently in place. Africa is susceptible to this influence; however, it cannot be fully concluded to what extent this would materialise (Bunde et al. 2023). Still, the fragile governments on the continent and its proximity to Europe make it a weak spot that can trigger effects in the EU, mostly related to continuous migration pressure north.

The potential **escalation of the conflict on the border between India and Pakistan** is a risk that can have ripple effects globally (Singh 2021). Despite multiple efforts to deescalate the decade-long confrontation, the issue persists and represents a security risk to South Asia (Global Conflict Tracker 2022), as well as the world. The conflict is seen as one of the most likely venues of a nuclear conflict as both sides are nuclear powers (White 2019). Should this risk increase further, especially in light of the overall shifts in security matters following the conflict on the European continent, involvement of Western

⁴⁸ <https://www.brinknews.com/chinas-economic-priorities-growth-stability-confidence/>

⁴⁹ <https://www.cfr.org/china-global-governance/>

⁵⁰ <https://www.coface.com/News-Publications/News/What-is-the-outlook-for-the-semiconductor-industry-with-its-proven-economic-and-geostrategic-importance>

⁵¹ https://www.ey.com/en_no/geostrategy/future-of-globalization

⁵² <https://www.africanews.com/2023/03/15/africa-facing-chinese-and-russian-influence/>

⁵³ <https://edition.cnn.com/2023/04/20/africa/wagner-sudan-russia-libya-intl/index.html>

⁵⁴ <https://www.euractiv.com/section/global-europe/news/africa-pays-the-price-as-china-and-russia-muscle-in/>



states seems likely. India has been recognised as a key partner of the US (The White House 2022) while at the same time it is a “swing” state in geopolitics (E&Y 2022). The potential escalation of the conflict globally, including with nuclear use, may have significant and hard to predict consequences for EU states such as massive migration waves and increase of military industry.

The Middle East remains one of the most unstable areas in the world. The role of **Iran** in the area and its overall positioning globally, including towards the West, and specifically to the US (The White House 2022), may trigger further destabilisation effects should the **US engage in military intervention to achieve a regime change** in the Muslim country (Geranmayeh 2023). With the unsuccessful attempts to negotiate with Iran, accompanied by strong civil movement within the country, the possibility of an intervention appears to be ever closer (Adebhar 2023). The risk is further increased by the provocations from the Iranian regime to the US specifically⁵⁵ as well as from the tension between Iran and Israel.⁵⁶ Should a political change in the US occur, that could shift the focus from a military action “as a last resort”⁵⁷ to actual action, the Middle East would further destabilise, and this would have an effect on the EU in terms of increased migration pressure (among others).

The Indo-Pacific region remains of key importance globally, especially for the West, as it is one of the areas where China attempts to establish more control. The **QUAD** cooperation group (Australia, India, Japan, USA) is an alliance that attempts to **establish more control in the Indo-Pacific** and thus to counteract Chinese interests there. As part of the overall shift to multiple geopolitical blocs, the efforts of the West will be centred on achieving this objective. Respectively, due to the too flexible geopolitical approach of countries such as India (Layton 2022), this influence expansion may be successful. At the same time, India’s economy is growing stronger and despite its attempt to balance its geopolitical positioning, it can be beneficial if it obtains an improved access to Western markets through such cooperation (Panda 2023). The US and the EU⁵⁸ recognise India as a strategic partner. As a strong trade partner, as well as an economy with increasing capability in technology and industry, an increased economic cooperation with the Indo-Pacific can trigger more investment flows for both sides, as well as potential follow up effects on migration to major urban centres and potentially negative effects in the same category in less developed regions of the EU.

⁵⁵ <https://www.theguardian.com/world/2023/mar/25/syria-biden-warns-iran-us-will-act-forcefully-to-protect-americans>

⁵⁶ <https://theintercept.com/2023/03/01/us-israel-iran-war/>

⁵⁷ <https://iranprimer.usip.org/blog/2023/jan/25/us-iran-threat-options>

⁵⁸ https://www.eeas.europa.eu/eeas/factsheet-eu-india-relations_en



T5: Tyranny of merit	
Time horizon	2050
Trend name	Tyranny of merit
Broader category	Social
Policy area	Economy
Method of delivery	Economic decisions, market dynamic, policy agenda
Time horizon	2050
Main trend elements	
T5.1. Income inequality: Continuous increase of income inequality (national and global).	
T5.2. Inequality of opportunity: housing, lack of social services, decreased social chances.	
T5.3. Inequality in labour: Hierarchy of labour market chances and lowered social mobility.	
Justification for the selection of trend elements	
<p>This trend is based on the idea of Tyranny of merit, expressed in the work with the same name by Michael Sandel (Sandel 2020). The idea outlines the negative effects of merit-driven economy and politics that continuously marginalise and decrease the chances of some social groups and disregard the systemic challenges that they face. The idea outlines a critique of the merit-contribution aspect of capitalism in its current form and argues for solutions.</p>	
Sectoral impact estimate	
<p>The tyranny of merit trend advances further the possibility of exacerbating existing inequalities and lack of equity in societies. The trend is not universal and can manifest differently in different national or transnational contexts (e.g. EU). These divisions and deep ruptures between social groups can have also territorial dimensions and solidify certain regions, cities, neighbourhoods or even countries (from EU perspective) as places with a disadvantaged position that can be stigmatised. From social perspective, this can have effects on the personal life trajectory of citizens whereas social chances would be difficult to change due to the solidified predetermination of those as a result of upbringing, social class and insufficient resources due to intergenerational poverty, for instance. As a result, three trend elements have been defined: increasing income inequality; increasing inequality of opportunity and concentration of resources in private capital, inequality in labour market and lower social mobility.</p> <p>The inequalities of all three types can be territorially concentrated which can result in deepening territorial disparities whereas growth regions and cities advance further at the expense of poorer regions (nationally and at EU level). The further division between social groups can lead to concentration of investments in sectors that do not create accessible jobs and do not produce positive effects for larger groups of society (e.g., lucrative sectors such as cryptocurrency) and this can lead to further worsening of inequality and poverty. As a result, increased social divide can occur between parts of countries and/or between countries and can further trigger migration waves within and between countries, especially to more wealthy regions as people with lower social chances would try to reach a better quality of life, despite their disadvantaged position. This division can result in the creation of elitist services (e.g., education, health) which can become increasingly inaccessible for citizens with limited resources. This can fuel social dissatisfaction and unrest against the established order (e.g., yellow vest movement in France). Migration waves can be affected by these changes whereas less developed regions and places keep losing population at the expense of growth poles while the population in those regions has less and less chances to access better education or jobs and to improve their quality of life. Unless public spending is increased, this can diminish further the chances to access housing and basic living conditions. These social divisions can put pressure on public spending by increasing investment in those areas. In addition, political parties with more radical positions can gain further support and can advance ideas for a complete turnover of the system or constructively attempt to change it to compensate for the lack of equity by balancing with quality-of-life considerations, for instance. From economic viewpoint, growth perspectives may remain focused in already developed regions at the expense of others that are left behind. From technological perspective, a hierarchy may occur whereas exclusive services and technology are accessible only for privileged</p>	



groups. Thus, the better opportunities that technology provides, e.g., for access to education, may be lost for some groups due to inaccessibility and digital divide.

Land use impact estimate	
Land use category	Anticipated impact
<i>Transport (incl. waterways)</i>	No impact
<i>Built-up area-Residential</i>	Expansive
<i>Built-up area-Industrial area and offices</i>	Inconclusive
<i>Agriculture-Greenhouses</i>	No impact
<i>Agriculture-Other</i>	No impact
<i>Woodland and nature</i>	No impact

The land use effects of these trend elements can be focused on *Built-up area-Industrial area and offices* in main growth centres, in addition to increased demand for *Built-up area-Residential* (expansive for both). This can occur at the expense of less developed regions where the pressure can be lower (restrictive for both). In growth centres, however, due to the effects of financialisation of housing – turning it into an asset instead of a social right – there might be further increase in the residential construction, for social groups who can afford it.

Dependence estimate

From current standpoint there appears to be a consensus on the need to rethink the conventional economic logic, therefore it is more likely that these ideas will gain traction, however, a complete overhaul of the system seems more unlikely than likely.

Uncertainty estimate

N/A

Overall probability estimate

0.67	Based on the reaction to the post-pandemic recovery and the overall shift to more leftist policy in the West as well as more involvement of the state, from today's perspective it seems that the traditional economic logic that reinforces the idea of tyranny of merit is being contested and this may lead to rethinking the way social contribution is viewed and to measures to mitigate inequalities.
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FURTHER BACKGROUND INFORMATION

The advancement of the tyranny of merit will vary depending on the national context and on the extent to which inequalities, injustice, hierarchy, and social mobility are viewed as an issue and are respectively being addressed. Should their effects be reinforced by lack of compensatory mechanisms, policies and equity measures, the existing inequalities in income, overall opportunity for improvement of living conditions (incl. access to services) and limited social chances from labour perspective may advance further and create long-lasting divisions in society. These divisions and deep ruptures between social groups can have also territorial dimensions and solidify certain regions, cities, neighbourhoods or even countries (from EU perspective) as places with a disadvantaged position that can be stigmatised. From social perspective, this can have effects on the personal trajectory of citizens whereas social chances would be difficult to change due to the solidified predetermination of those due to upbringing, social class and insufficient resources as a result of intergenerational poverty, for instance.

Global and national **income inequality** and poverty are major international challenges. It is estimated that 52% of global income is concentrated in the richest 10% people on the planet (World Inequality Lab 2021). There are significant regional differences of this score whereas Europe is the least global region with the top 10% income share accounting for 36% of national income, while the bottom 50% income share accounts for ±28%. This distribution is in contrast with other global regions, including neighbouring ones to Europe, where the concentration of the income in the top 10% surpasses 40% or even 50% as opposed to less than 15% concentrated in the bottom 50%. These global dimensions have even worsened after the Covid-19 pandemic and they also have different manifestations within national contexts (where some countries might be overall richer, but still very unequal) (World Bank 2022a). The increasing disparities



also within global political blocs, such as the EU, may give rise to phenomena such as the “geography of discontent” (Dijkstra, Poelman, and Rodríguez-Pose 2020). These can manifest as long-term trajectories of poverty and marginalisation of regions, cities or countries as opposed to economic winners and places with “better image”. In case no additional policy measures are implemented for such places, the chances of individuals living in them (in terms of improving material conditions, access to education and labour market) can further deteriorate, together with their quality of life. As a follow up effect, this can trigger further support for populist parties and overall social dissatisfaction.

The inequality question also concerns **inequality of opportunity** that is especially acute in certain sectors, such as housing and social services. The possible withdrawal of the state and public sector of these industries and policy areas and the increased dependence on private capital, paired with financialisation of housing (United Nations 2017) can trigger severe social crises and political turmoil. This possibility is worsened by the decreasing efforts to fight back corruption globally and the increasing entanglement between public institutions and private interests (Transparency International 2022). The recent health and economic crises have also highlighted the risk of hierarchisation of jobs and social functions whereas “essential workers” were most exposed to the risks of the pandemic, while privileged white collar workers took advantage of access to technology and adapted their lifestyle to teleworking. These tendencies can be aggravated by the digital divide, whereas digital technology becomes also increasingly inaccessible, despite being an alternative for access to education or even for basic communication, especially for disadvantaged groups or people living in remote areas.⁵⁹ These examples of lack of equity are also worsened by the disproportionate effects on certain societal groups and marginalised communities such as minorities, migrants, and families with intergenerational poverty. The dependence of key social services from private capital may lead to overall decrease of social cohesion, concentration of poverty in urban areas and potential increase of migration to rural regions due to the lower cost of living.

The stigmatisation of certain social groups or places can also have effects on labour markets and overall economic activity. The concentration of disadvantaged citizens in certain pockets of poverty can lead to deterioration of educational quality and further decrease their social chances. The increasing divide between elitist and “mass” education (and other social services) can have effects on economic development, especially in developing countries (Castello-Climent and Mukhopadhyay 2013). Such differences may arise also within the EU – between member states or within member states. As a result, further concentration of capital and groups benefiting from it can occur in established economic centres while less developed regions, cities and areas can continue losing population and decreasing their quality of life.

The challenges of inequality have given rise to a significant debate on overcoming the negative of the current economic and political order. From European perspective, the environmental ambition of the EU is seen as a vehicle to transition the economy while balancing environmental and social consequences.⁶⁰ On global level, different stakeholders are contesting the established way of viewing the world, dominated by the neoliberal ideology introduced in the late 20th century (Davies and Nicholas Gane 2021). This idea has also been enforced by recent political shifts in major economies, such as the US.⁶¹ The need to **rethink the existing economic models** that trigger major inequality challenges posed by capitalism has been a continuous effort of major international organisations as well as advocacy groups, especially in the wake of the Covid-19 pandemic (Oxfam 2022). The need to shift values and rethink priorities of the global economy is an open question on international fiscal and monetary policy and following the pandemic is already suggesting rethinking of public spending and changing the role of the state (World Bank 2022b). The ambition and implementation of this rethinking of the current economic and political order will depend mostly on political decisions and reactions from the market.

⁵⁹ <https://www.weforum.org/agenda/2021/06/digital-equity-tackling-tech-poverty/>

⁶⁰ https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

⁶¹ <https://www.ft.com/content/e04bc664-04b2-4ef6-90f9-64e9c4c126aa>





ANNEX 3 – LAND USE TAXONOMY

CBS category	Explanation	Urban Atlas category	Explanation	Differences
Transport (total)	<p>Area in use for traffic and transport on roads, on railways and in the air.</p> <p>Railroad - Area in use for traffic and transport on railways. Including slopes; dead end rails to industrial area; shunting area; railway yard including station buildings and adjacent parking areas. Excluding narrow gauge, this is included at the adjacent land use.</p> <p>Main road - Area in use for traffic and transport over the main road network. Including roads with function of transportation artery; included green in connections with roads and inside roundabouts; parking areas; busstation; gasoilstation; storages for road maintenance. Excluding included green, larger than 1 ha in use of agriculture or woodland; included water larger than 1 ha; main road under construction.</p> <p>Airport - Area in use for traffic and transport in the air. Including paved and unpaved airstrips; associated buildings and parking areas. Excluding unpaved soil inside the enclosed airport (not belonging to airstrips); adjacent areas with services and industries.</p>	Transport (total) – manual calculations	Manual sum of land use categories Airports, Fast transit roads and associated land, Other roads and associated land, Railways and associated land.	
Inland water	IJsselmeer/Markermeer, Enclosed estuary, Rijn and Maas, Randmeer, Water reservoir, Water with recreational usage, Water where minerals are extracted, Area for storing industrial water, Other inland water	Water	Water bodies (no differentiation)	In the case study analysis, waterways are considered as part of transport infrastructure. In land use profiles of the cases, the water shares are displayed as a separate category so as not to distort the transport category (e.g., in Rotterdam the share of water is above 17%)



Built-up area- Residential	Area mainly used for residents, including primary amenities. Including housing areas; primary amenities e.g. (local) shops, primary schools; local offices of e.g. banks; green areas smaller than 1 hectare; streets and local parking areas; courtyards, gardens; playing grounds; trailer camp (excluding wreckage areas larger than 0,1 hectare). If residential areas are inside woodland, the total area is assigned as residential if a street pattern can be recognized.	Built-up area- Residential (manual calculations)	Manual sum of land use categories: Continuous urban fabric (S.L. : > 80%); Discontinuous dense urban fabric (S.L. : 50% - 80%); Discontinuous low density urban fabric (S.L. : 10% - 30%); Discontinuous medium density urban fabric (S.L. : 30% - 50%). The urban fabric categories are distinguished by their degree of soil sealing, named <i>sealing layer</i> (S.L.). Continuous urban fabric layers present a sealing layer coverage higher than 80% of the size of the mapping unit. Discontinuous urban fabric layers present sealing layer coverage below 80% of the size of the mapping unit and are subdivided as the degree decreases. <i>Mapping unit</i> refers to the polygons that contain land cover information and serve as base for the development of the Urban Atlas.	Continuous urban fabric (S.L.: >80%) in Copernicus Urban Atlas also includes business office zones. In CBS categorization, the offices are part of Built-up area-Industrial area and offices.
Built-up area- Industrial area and offices	Area in use for industry, retail and business services. Including industrial area; harbour area; auction area; exhibition area; cattle market (including covered areas); wholesale business area; area with banks, insurance companies etc.; associated storage areas and parking areas; garages (including parking areas); garage of bus companies; offices; associated parking areas. Excluding included non-used areas or areas not yet ready for building or construction, these are assigned to building sites.	Built-up area- Industrial area and offices (manual calculations)	Manual sum of land use categories: Industrial, commercial, public, military and private units; Port areas	Industrial, commercial, public, military and private units in Copernicus Urban Atlas also includes greenhouses. In CBS categorization, the greenhouses are a separate land use category.



Agriculture-Other	Area for agriculture without glass, like pastures, fields and orchards. Including grassland (hayland and pastures) including the grass grows dikes and river forelands; area for cattle breeding; orchards, including underplanting, maintenance paths and windbreaks; horticulture and arable farming; cultivation of small fruits; scattered houses with associated yards and gardens, as far as they are in the middle or adjacent to agricultural area; natural grassland.	Agriculture-Other (manual calculations)	Manual sum of land use categories: Arable land (annual crops), Pastures, Permanent crops (vineyards, fruit trees, olive groves)	
Agriculture-Greenhouses	Area in use for agriculture in greenhouses. Including area of the cultivation of plants under glass in greenhouses; associated waterbasins.	N/A		Greenhouses are included in Industrial, commercial, public, military and private units in Copernicus Urban Atlas
Woodland and nature	<p>Woodland - Area with trees for wood production and nature conservation. Including area with trees of which the crowns are a closed entity; cutting field; fire lane; forest path; nursery of forests; storage of wood; scattered houses, if placed inside the woodland; poplar fields. Excluding wooded areas of parks; forest nurseries that are outside the woodland; residential areas (with a pattern of streets) and areas of recreational houses inside the woodland.</p> <p>Dry natural open area - Open area with a dry surface, mainly nature. Including dry heather; grasslike natural area (not for agricultural use); dunes; sand drift; sandbar; beach.</p> <p>Wet natural open area - Open area with a wet surface, mainly nature. Including wet heather; reed and rush (including cultivations); salt marsh (not innundated at normal high tides); tidal soil, if barren; bluegrass land. Excluding osier bed; wet woodland.</p>	Woodland and nature (manual calculations)	Manual sum of land use categories: Forests, Herbaceous vegetation associations (natural grassland, moors...), Open spaces with little or no vegetation (beaches, dunes, bare rocks, glaciers), Wetlands	

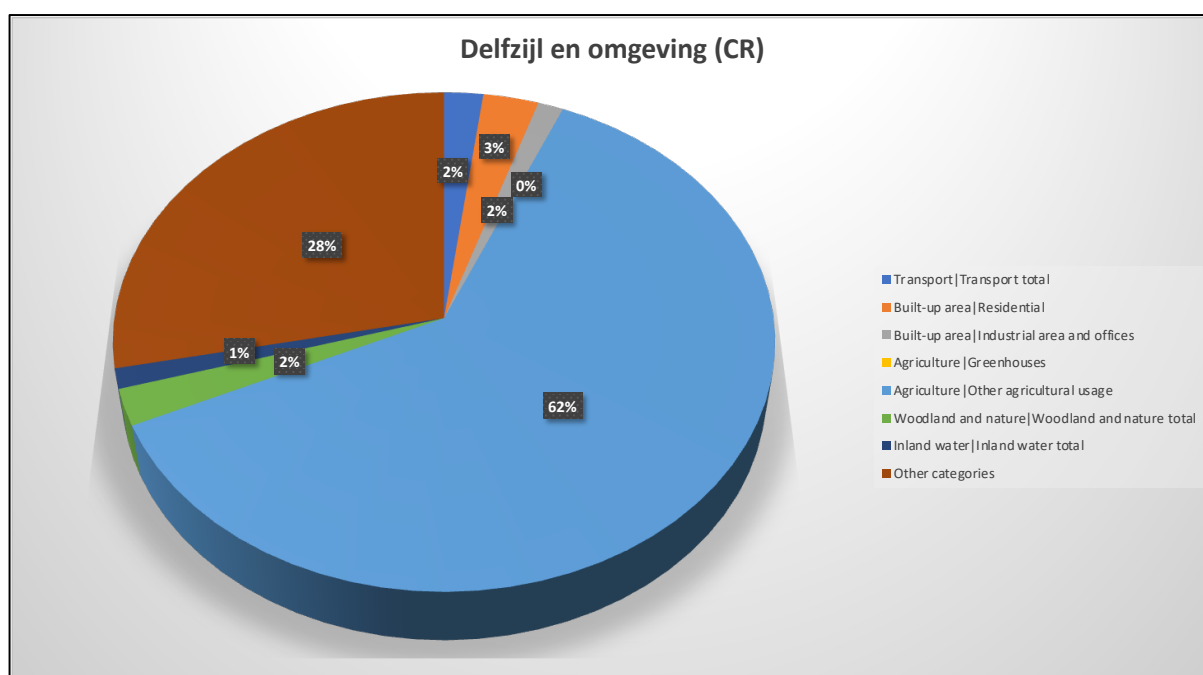


ANNEX 4 – LAND USE PROFILES OF CASE STUDIES

Land use profile – Delfzijl en omgeving

Land use category (ha)/Region	Netherlands	Delfzijl en omgeving (CR)
Total surface	4154303	36407
Transport Transport total	115563	761
Built-up area Residential	235839	1082
Built-up area Industrial area and offices	86336	495
Agriculture Greenhouses	15511	0
Agriculture Other agricultural usage	2220806	22473
Woodland and nature Woodland and nature total	498956	858
Inland water Inland water total	371941	473
Other categories		10265
Transport % of total surface	2,78%	2,09%
Residential % of total surface	5,68%	2,97%
Industrial % of total surface	2,08%	1,36%
Greenhouses % of total surface	0,37%	0,00%
Other agricultural % of total surface	53,46%	61,73%
Woodland and nature % of total surface	12,01%	2,36%
Inland water % of total surface	8,95%	1,30%

Total land in hectares in the selected land use categories of Delfzijl en omgeving as compared to the Netherlands; Source: CBS Land use; all categories, municipalities; COROP regions, 2015; Red colour: lower than national share, green colour: higher than national share.



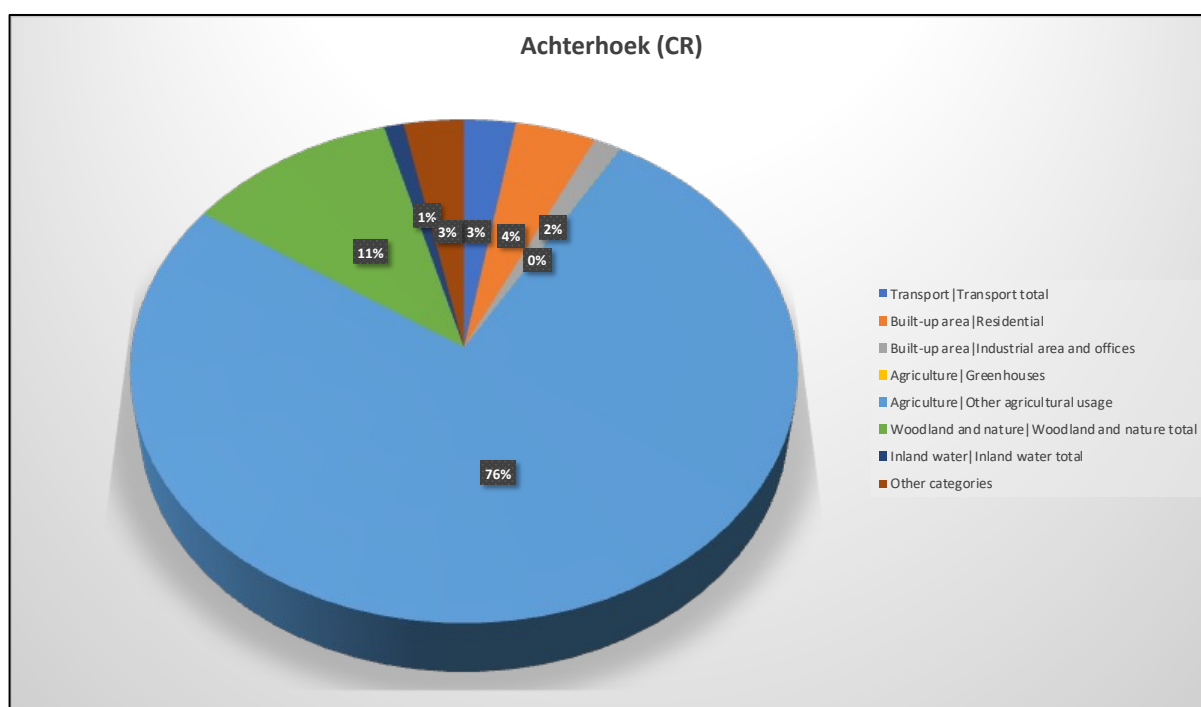
Percentage share of the selected land use categories of Delfzijl en omgeving; Source: CBS Land use; all categories, municipalities; COROP regions, 2015.



Land use profile – De Achterhoek

Land use category (ha)/Region	Netherlands	Achterhoek (CR)
Total surface	4154303	156108
Transport Transport total	115563	4279
Built-up area Residential	235839	6716
Built-up area Industrial area and offices	86336	2241
Agriculture Greenhouses	15511	24
Agriculture Other agricultural usage	2220806	118702
Woodland and nature Woodland and nature total	498956	17523
Inland water Inland water total	371941	1638
Other categories		4985
Transport % of total surface	2,78%	2,74%
Residential % of total surface	5,68%	4,30%
Industrial % of total surface	2,08%	1,44%
Greenhouses % of total surface	0,37%	0,02%
Other agricultural % of total surface	53,46%	76,04%
Woodland and nature % of total surface	12,01%	11,22%
Inland water % of total surface	8,95%	1,05%

Total land in hectares in the selected land use categories of Achterhoek as compared to the Netherlands; Source: CBS Land use; all categories, municipalities; COROP regions, 2015; Red colour: lower than national share, green colour: higher than national share.



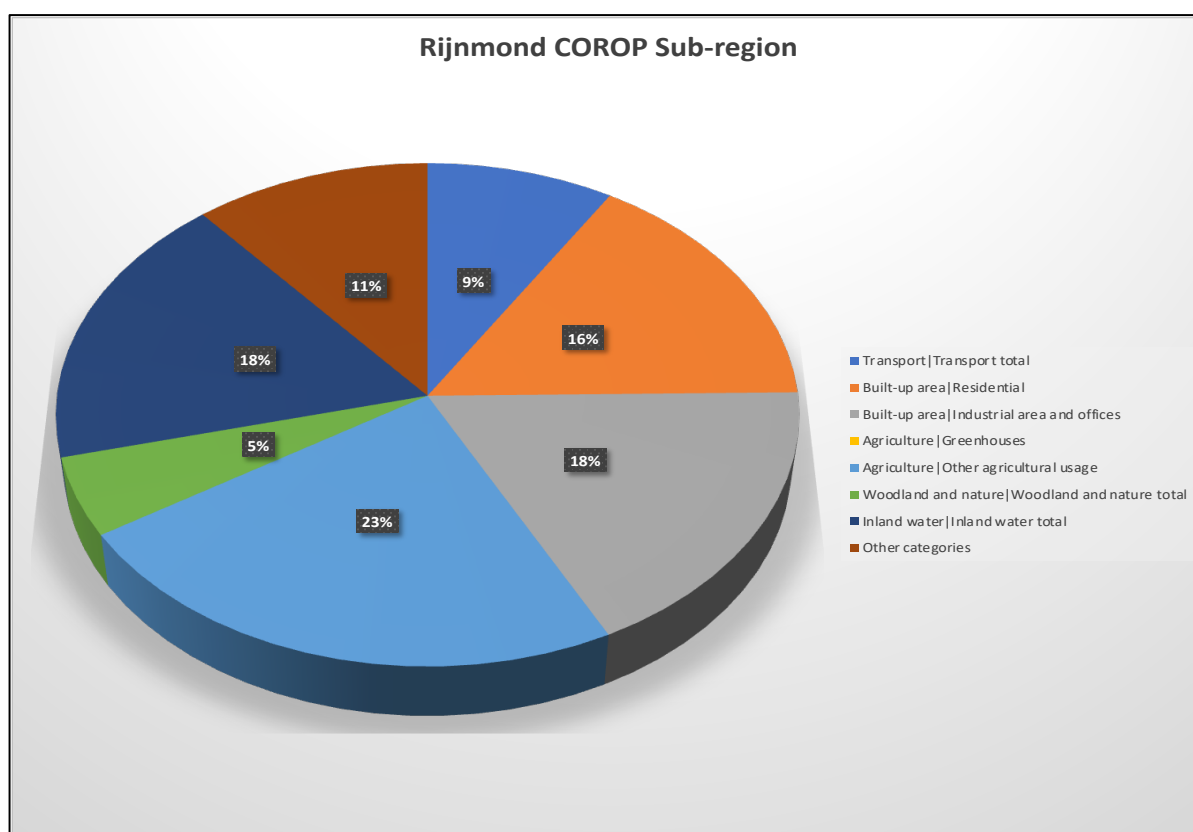
Percentage share of the selected land use categories of Achterhoek; Source: CBS Land use; all categories, municipalities; COROP regions, 2015.



Land use profile – Rijnmond

Land use category (ha)/Region	Netherlands	Rijnmond COROP Sub-region
Total surface	4154303	73950
Transport Transport total	115563	6493,25
Built-up area Residential	235839	11829,40
Built-up area Industrial area and offices	86336	13087,43
Agriculture Greenhouses	15511	
Agriculture Other agricultural usage	2220806	17419,27
Woodland and nature Woodland and nature total	498956	3751,99
Inland water Inland water total	371941	13158,17
Other categories		8210
Transport % of total surface	2,78%	8,78%
Residential % of total surface	5,68%	16,00%
Industrial % of total surface	2,08%	17,70%
Greenhouses % of total surface	0,37%	
Other agricultural % of total surface	53,46%	23,56%
Woodland and nature % of total surface	12,01%	5,07%
Inland water % of total surface	8,95%	17,79%

Total land in hectares in the selected land use categories of Rijnmond as compared to the Netherlands; Source: Copernicus Urban Atlas 2018, LAU borders; Red colour: lower than national share, green colour: higher than national share.



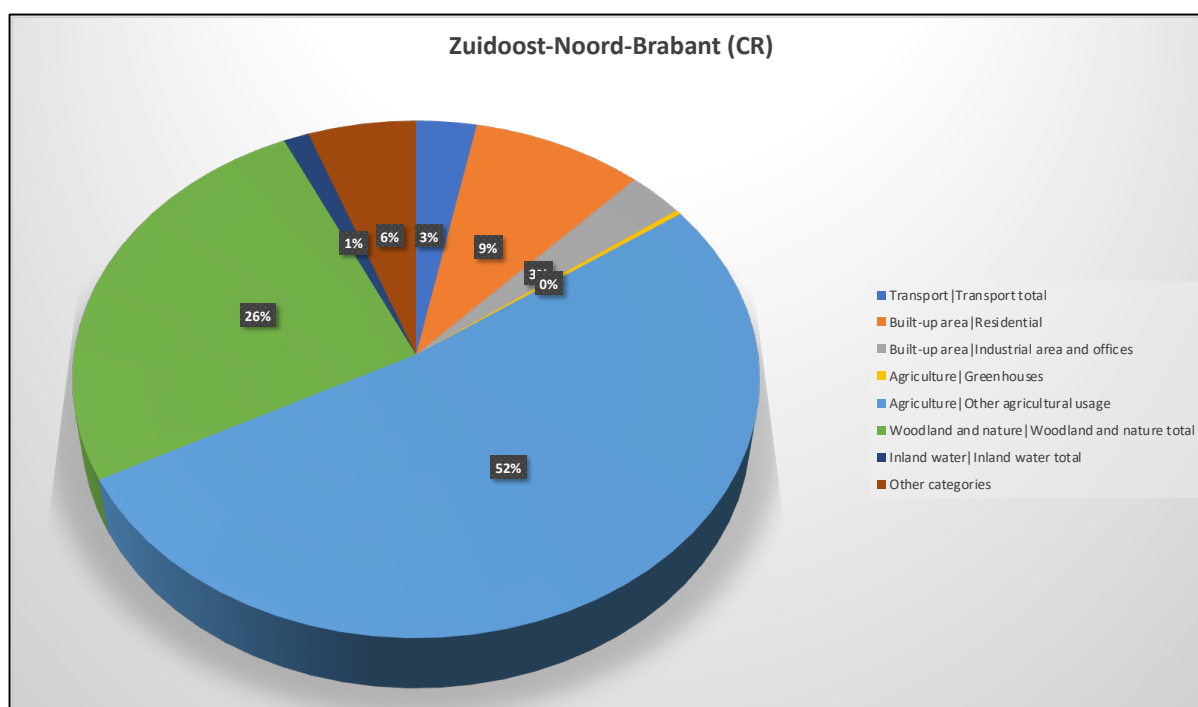
Percentage share of the selected land use categories of Rijnmond; Source: Copernicus Urban Atlas 2018, LAU borders



Land use profile – Zuidoost-Noord-Brabant

Land use category (ha)/Region	Netherlands	Zuidoost-Noord-Brabant (CR)
Total surface	4154303	145766
Transport Transport total	115563	4542
Built-up area Residential	235839	12915
Built-up area Industrial area and offices	86336	4234
Agriculture Greenhouses	15511	426
Agriculture Other agricultural usage	2220806	75956
Woodland and nature Woodland and nature total	498956	37650
Inland water Inland water total	371941	1912
Other categories		8131
Transport % of total surface	2,78%	3,12%
Residential % of total surface	5,68%	8,86%
Industrial % of total surface	2,08%	2,90%
Greenhouses % of total surface	0,37%	0,29%
Other agricultural % of total surface	53,46%	52,11%
Woodland and nature % of total surface	12,01%	25,83%
Inland water % of total surface	8,95%	1,31%

Total land in hectares in the selected land use categories of Zuidoost-Noord-Brabant as compared to the Netherlands; Source: CBS Land use; all categories, municipalities; COROP regions, 2015; Red colour: lower than national share, green colour: higher than national share.



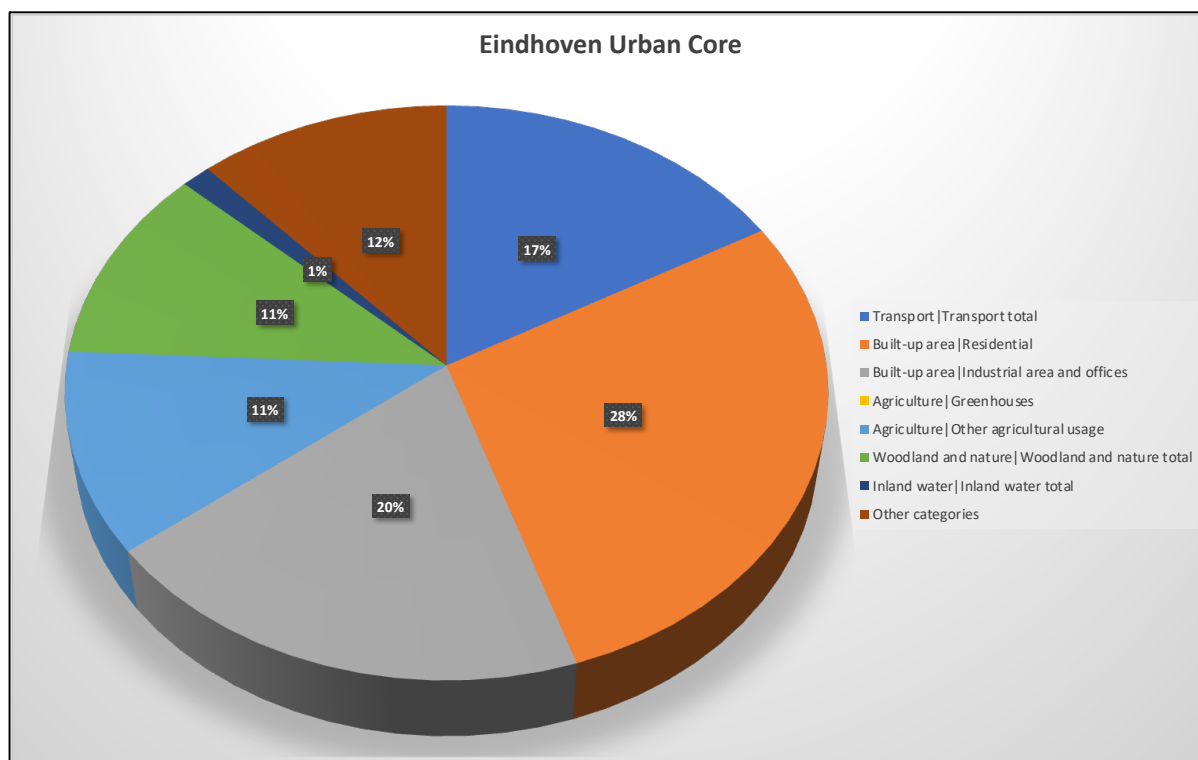
Percentage share of the selected land use categories of Zuidoost-Noord-Brabant; Source: CBS Land use; all categories, municipalities; COROP regions, 2015.



Land use profile – Eindhoven

Land use category (ha)/Region	Zuidoost-Noord-Brabant (CR)	Eindhoven Urban Core
Total surface	145766	8886
Transport Transport total	4542	1488,44
Built-up area Residential	12915	2506,46
Built-up area Industrial area and offices	4234	1732,86
Agriculture Greenhouses	426	
Agriculture Other agricultural usage	75956	1005,50
Woodland and nature Woodland and nature total	37650	985,47
Inland water Inland water total	1912	121,67
Other categories	8131	1045
Transport % of total surface	3,12%	16,75%
Residential % of total surface	8,86%	28,21%
Industrial % of total surface	2,90%	19,50%
Greenhouses % of total surface	0,29%	
Other agricultural % of total surface	52,11%	11,32%
Woodland and nature % of total surface	25,83%	11,09%
Inland water % of total surface	1,31%	1,37%

Total land in hectares in the selected land use categories of Eindhoven Urban Core as compared to Zuidoost-Noord-Brabant; Source: Eindhoven: Copernicus Urban Atlas 2018, LAU borders; Zuidoost-Noord-Brabant: CBS Land use; all categories, municipalities; COROP regions, 2015; Red colour: lower than national share, green colour: higher than national share.



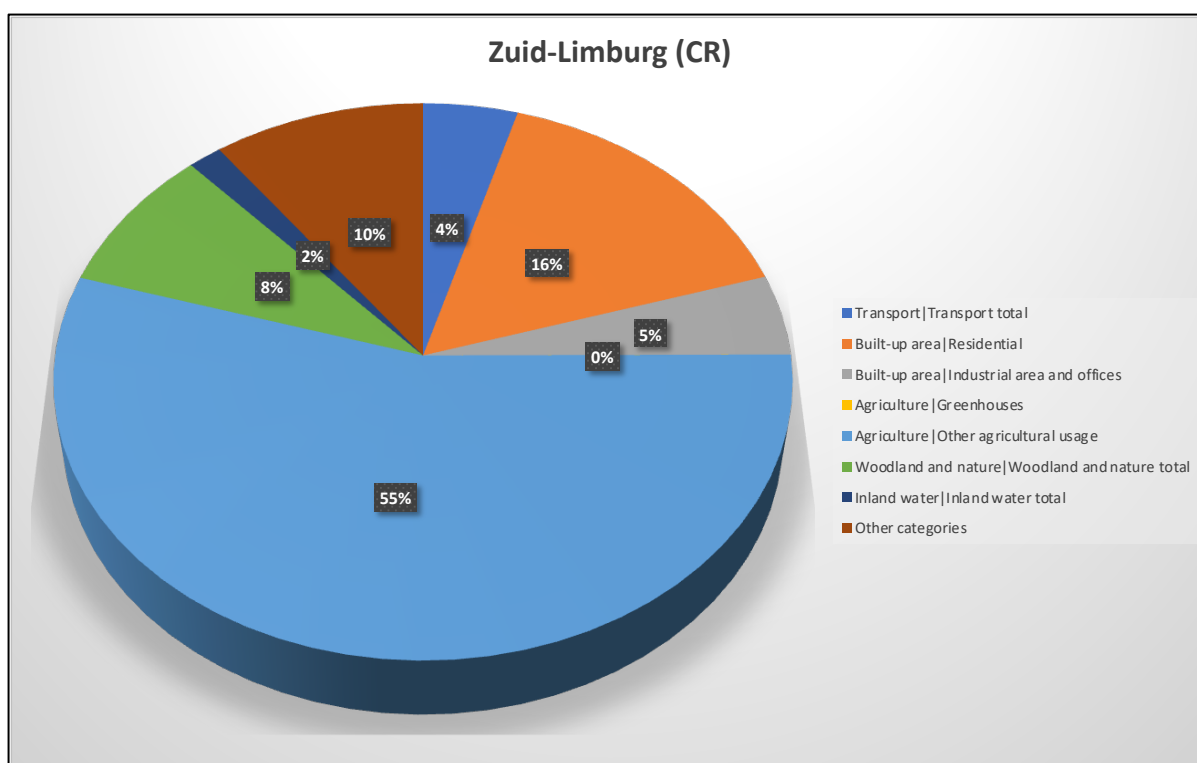
Percentage share of the selected land use categories of Eindhoven; Source: Copernicus Urban Atlas 2018, LAU borders.



Land use profile – Zuid-Limburg

Land use category (ha)/Region	Netherlands	Zuid-Limburg (CR)
Total surface	4154303	66056
Transport Transport total	115563	2996
Built-up area Residential	235839	10389
Built-up area Industrial area and offices	86336	3092
Agriculture Greenhouses	15511	1
Agriculture Other agricultural usage	2220806	36149
Woodland and nature Woodland and nature total	498956	5637
Inland water Inland water total	371941	1076
Other categories		6716
Transport % of total surface	2,78%	4,54%
Residential % of total surface	5,68%	15,73%
Industrial % of total surface	2,08%	4,68%
Greenhouses % of total surface	0,37%	0,00%
Other agricultural % of total surface	53,46%	54,72%
Woodland and nature % of total surface	12,01%	8,53%
Inland water % of total surface	8,95%	1,63%

Total land in hectares in the selected land use categories of Zuid-Limburg as compared to the Netherlands; Source: CBS Land use; all categories, municipalities; COROP regions, 2015; Red colour: lower than national share, green colour: higher than national share.



Percentage share of the selected land use categories of Zuid-Limburg; Source: CBS Land use; all categories, municipalities; COROP regions, 2015.



ANNEX 5 – Summary table of the EU policies and global trends, overall probability estimate, and land use impact estimate

Policy and trend index	P1	P2	P3	P4	P5	T1	T2	T3	T4	T5
Policy name/Global trend	European Green Deal (2030 and 2050)	EU Circular Economy Action Plan and Strategy (±2050)	EU Biodiversity Strategy 2030	Connecting Europe Facility (2021-2027)	Europe Fit for the Digital Age 2030	Increasing shift to renewables	Working from anywhere	Accelerated digitalization and omnichannel futures	Global geostrategic plans of others (outside of Europe)	Tyranny of merit
Broader category (political, economic, environmental, social, technological)	High level policy agenda (outlier)	Technological	Environmental	Economic	Technological	Environmental	Economic	Technological	Political	Social
Policy area (economy, agriculture etc)	High level policy agenda (outlier)	Economy	Biodiversity	Infrastructure	Economy	Energy	Labour	Technology	Politics/Geopolitics	Economy
Time horizon	2030 and 2050	2030 and 2050	2030	2030 and 2050	2030	2030	2030	2030	2050	2050
Overall probability estimate	0,63	0,74	0,69	0,72	0,42	0,98	0,57	0,74	0,55	0,67
Land use impact estimate										
Transport (incl. waterways)	Expansive	Restrictive	No impact	Expansive	No impact	No impact	Inconclusive	Restrictive	No impact	No impact
Built-up area-Residential	Inconclusive	No impact	Restrictive	Expansive	Expansive	Expansive	Expansive	Expansive	Expansive	Expansive
Built-up area-Industrial area and offices	Restrictive	Expansive	Restrictive	Inconclusive	Expansive	Expansive	Restrictive	Expansive	Expansive	Inconclusive
Agriculture-Greenhouses	Expansive	No impact	Expansive	No impact	No impact	No impact	No impact	No impact	No impact	No impact
Agriculture-Other	Expansive	No impact	Expansive	Inconclusive	Restrictive	Restrictive	No impact	No impact	No impact	No impact
Woodland and nature	Expansive	Expansive	Expansive	No impact	Restrictive	Restrictive	No impact	No impact	No impact	No impact





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