

## **INLAND PORTS IN TRANSITION - A GREEN PORT MASTER PLAN FOR THE PORT OF VENLO**

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## **Summary**

In Europe, the ongoing shift towards Climate Neutrality is a focal point, supported and expedited by a comprehensive policy and legislative initiative known as the Green Deal. This transition has significant implications for inland ports and their stakeholders. For inland port authorities or municipalities governing inland port activities this poses challenges on the role they should take in this transition. Within the PIONEERS project, this challenge is being addressed by the development of a Green Port Master Plan. This paper elaborates on the development of a Green Master Plan for port of Venlo. The chosen methodological framework for this approach is the Multi Level Perspective, a methodology specifically designed to offer guidance in complex sustainability transitions. The application of this methodology unfolds in the context of the Port of Venlo's greening transition challenge and its Green Master Plan development. The paper describes the implementation of the ten-step approach of the Green Port Master Plan for the Port of Venlo. It highlights how the Green Master Plan effectively involves and mobilizes the inland port stakeholders in aligning the climate neutrality ambitions. The Green Master Plan gives strategic direction to port restructuring and port expansion initiatives.

## **1. Introduction**

Amidst the ongoing transition towards Climate Neutrality a plethora of legislative proposals and support policies are currently under development. These initiatives provide guidance to not only the European Union as a whole and individual Member states, but also to specific industry sectors and individual companies, indicating the steps to be taken in this transition. However, the question arises concerning entities that comprise of multiple organisations, such as business parks, industrial clusters, ports or inland ports. Depending on the governance model for these clusters, the respective governing authority or body bear the responsibility of offering guidance and direction. This also extends to inland ports like Port of Venlo, which operates under a governance model with limited executive authority. The majority of legislative initiatives fail to offer clear direction to these representative bodies, nor do they comply as entity with most regulatory measures. Thus, the challenge emerges: how should such entities approach this sustainability transition and actively engage in this process? This paper addresses these challenges and elaborates how the Port of Venlo is approaching this transitional challenge within its operational and strategic context.

## **2. The context of the Port of Venlo**

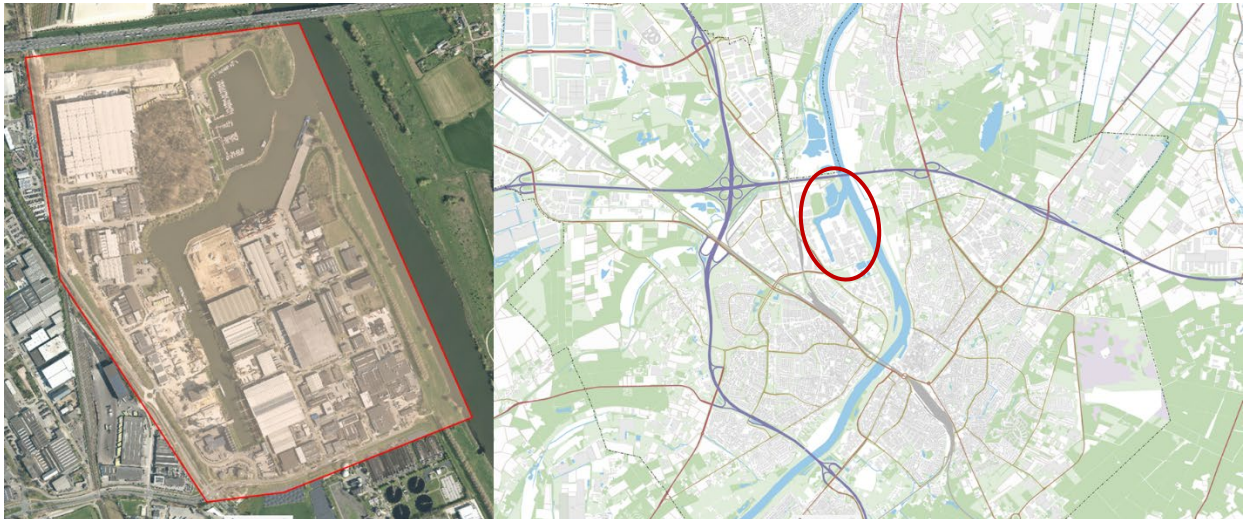
### **2.1 Part of a major multimodal logistics inland hub**

Inland ports are dominantly associated with the container handling, both maritime and domestic. Inland ports are interconnected with port terminals via a high capacity corridor, typically served by truck shuttle services, yet ideally featuring dedicated rail and barge links (Rodrigue, 2010). Situated along the most important European freight corridors – the TEN-T Rhine-Alps and North Sea-Mediterranean route -, the multimodal logistics hub of Venlo plays an pivotal role in facilitating the hinterland connections of the ports of Rotterdam and Antwerp. The inland container port and the four rail terminals offer frequent shuttle services with Rotterdam and Antwerp, thus offering valuable connectivity services to the logistics parks in the Venlo region, the Venlo Trade Ports. These Trade Ports belong to the largest logistics sites in the Netherlands and have an important (inter)national function as a logistics industrial hub. As such, Venlo conforms to the definition of an inland Port (Rodrigue, 2010). Positioned along the river Maas, the port of Venlo encompasses a multifunctional container port and an industry port.

The development of the Port of Venlo is imperative to gain strength and significance within the European Core Network, a prerequisite for driving regional economic pillars such as agribusiness, manufacturing industry and logistics and as part of the logistics hotspot Venlo; characterised by the Greenport Venlo initiative. To achieve this objective, strategic choices in areas such as multimodality, sustainability, economy and safety are delineated. The Venlo Port Vision 2020 elaborated this ambitious trajectory (Municipality of Venlo, 2020).

## 2.2 Key characteristics of Port of Venlo

The Port of Venlo is a medium-sized multifaceted (container, dry and liquid bulk) inland port within the province of Limburg, strategically positioned along the River Maas. The Port of Venlo is an undefined entity, covering the activity of around 45 companies included in the geographic area specified in figure 1.



*Figure 1: Port area Venlo*

The municipality of Venlo is the decision-making body for the port, without a distinct port authority. The management of port operations fall under the responsibility of the College of Mayor and Aldermen. In principle, the municipality assumes not a landlord role. The municipality of Venlo only owns the public space, notably infrastructure such as roads, with the exception for the provision of land for the (extended) barge terminal, which has been leased on a long-term basis. The port's annual throughput is around 1.7 million tonnes of bulk goods and around 80.000 TEUs of containers processed through the barge terminal. The number of ships calling to the port approach nearly 1300 annually. The entirety of the Venlo logistics hub, including a barge terminal and four rail terminals, can handle up to 2 million TEUs.

The Inland Port Monitor 2021, conducted by Erasmus University (Streng, 2021) quantifies the direct and indirect economic impact of the Port of Venlo. Collectively the around 45 companies in the port employ approximately 800 people, generating a direct added value of more than €80 million. However, the indirect impact on the broader region is much higher. It serves as one of the key locational factors for companies that concentrate their European distribution networks from Venlo, via the extensive warehousing and EDCs in the Venlo region, with almost 2.4 million square metres (Bak, 2022).

### **2.3 The EU PIONEERS project and Port of Venlo Greening Strategy**

Venlo is a member of the PIONEERS consortium alongside the ports of Antwerp-Bruges, Barcelona and Constanta, in addition to 42 other partners. PIONEERS is a Horizon 2020 project embodying the acronym Portable, Innovation Open Network for Efficiency and Emissions Reduction Solutions. The consortium addresses the challenges faced by European ports to reduce their environmental impact while remaining competitive and offering added value in a sustainable global trade ecosystem. PIONEERS develops knowledge and expertise, pilot projects and facilitates the exchange of insights and experiences on sustainable port innovations. For Venlo, participation in PIONEERS represents an opportunity to strengthen its knowledge base about innovations and their practical implementation. One of the main tasks for Venlo Municipality in PIONEERS is the development of a Green Port Master Plan (GPMP). Within the GPMP, each participating port tailors this sustainability challenge and transitional challenges to its unique contexts. The Brightlands Institute for Supply Chain Innovation (BISCI), affiliated with Maastricht University (UM), serves as the primary knowledge collaborator for Venlo for the development of the GPMP.

### **3. The Green Transition Framework for Port of Venlo**

In the Green Master Planning, we apply a methodological framework specifically designed to support sustainability transitions, known as the Multi Level Perspective (MLP). This chapter elaborates on the application of this methodology within the Green Master Planning initiative for the Port of Venlo.

In the GPMP approach, it became evident that a nuanced understanding of the dynamics of ecosystems being in transition was imperative. The next sections elaborate on the corresponding Multi Level Perspective methodology being applied.

#### **3.1 Multi Level Perspective as framework for sustainability transition management**

The multi-level perspective (MLP) is an analytical tool designed to address the complexity and resistance to change inherent in sustainability transitions (Geels, 2004). Focussing on the dynamics of wider transitional developments as opposed to discrete technological innovations, the MLP concerns itself with socio-technical system transformations, particularly with transitions towards sustainability and resilience (Geels, 2010). As such, the MLP provides a structured approach to think about and discuss system innovations like the sustainable transition (Vandermeeren, 2023). The MLP has been applied to various contexts, including sustainable agrifood transitions (Bilali, 2019) and greening initiatives in the automotive industry (Bree, 2010).

The MLP distinguishes three levels of analysis: (a) the socio-technical landscape offering the exogenous context, (b) the socio-technical regime that is undergoing the transition, and (c) the niche innovations

being initiated by small networks of actors in the regime. A graphical representation can be found in figure 2.

Increased structuration  
of activities in local practises

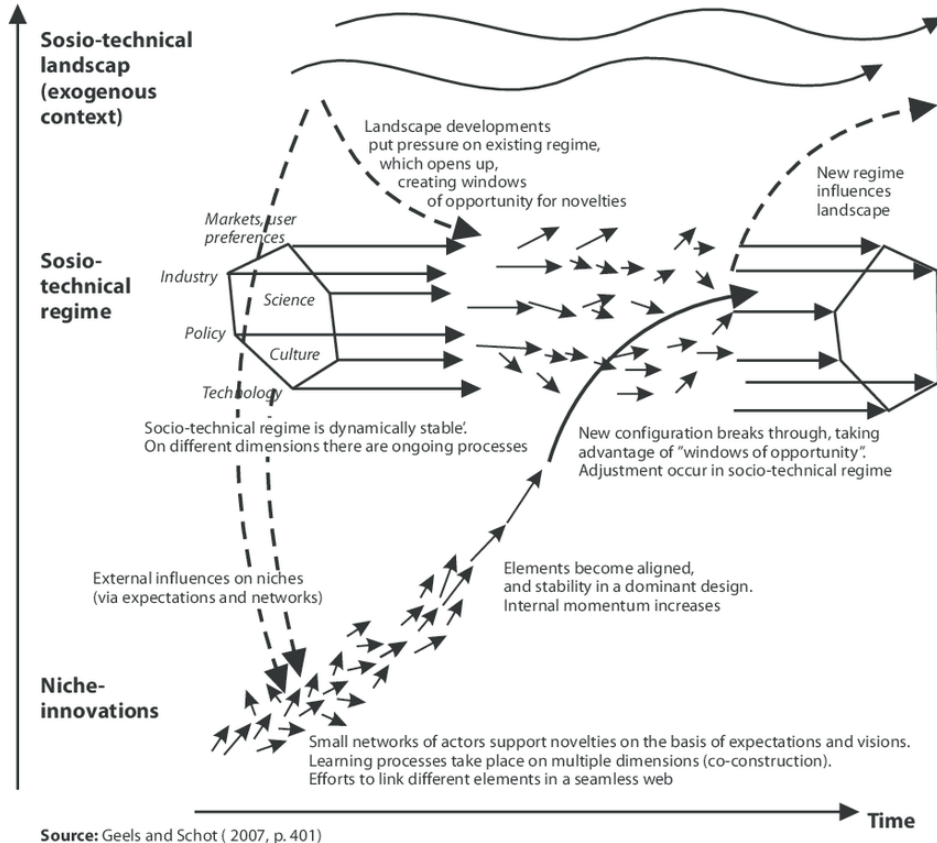


Figure 2: The Multi Level Perspective (Geels, 2007)

### 3.2 The inland port regime of Venlo

When applying this framework on the sustainability transition challenges of Port of Venlo, the term "regime" refers to the stability of the existing socio-technical system of the Port of Venlo. This includes various sub-regimes such as freight transport markets, port user preferences, socio-economic policies, port greening technology, science and know-how, and culture, all of which exhibit a degree of alignment. Sustainability policy and regulatory developments form presumably the most prominent threads to the stability of the inland port regime. We therefore address this aspect in more detail in a separate chapter (Chapter 4). Moreover, science and know-how prove to be relevant aspects for Port of Venlo. Within the municipality of Venlo, there is no structurally dedicated team tasked with the development of the port. The harbor master has operational responsibilities, ensuring safe navigation and collecting port fees. And a project-based team is investigating a potential extension along the north shore. Venlo's

participation in PIONEERS thus helps building additional knowledge capacity essential for the development of a GPMP.

### **3.3 The Port of Venlo landscape developments**

The socio-technical landscape of the inland port is undergoing dynamic shifts, putting pressure on the existing inland port regime (a.k.a. regime dynamics). Global developments shaping this landscape include elements such as global warming, geopolitical power shifts, population growth and other macro-economic or macro-political trends. On a national level, the changing government stance towards the role of the logistics sector in our society is a highly relevant development for the Port of Venlo regime. The National College of Government Advisors published a critical reflection paper on Tomorrow's Logistics (Veldhuis, 2023). The report attempts to answer the question 'How can we work on a healthy blood circulation for the circular economy?'. The advice is rather critical on the sustainability of the existing spatial policy choices facilitating the strong growth of huge warehouses and distribution centers, with high volumes of migrant workers, housing challenges, network congestion issues and low wages. It argues for an expedited transition from fossil-fuel-based industry and corresponding logistics towards a circular economy. A similar sentiment is echoed in the publication "Ruimte voor de Circulaire Economie" from the Dutch Planbureau voor de Leefomgeving, called (PBL, 2023). These policy and vision papers from governmental bodies reflect a shift within the Dutch government towards logistics and the current paradigm of being the Gateway to Europe as a distribution hub.

On a local level, the perception of a successful logistics hub strategy is shifting from a volume-oriented to a value-oriented approach. The economic vision outlined by the Municipality of Venlo is an elaboration of the economic ambitions and objectives outlined in the Strategic Vision 2040. Together with its strategic partners, the municipality developed a new trajectory with motto 'From volume to value'. This revised economic course aims to increase Venlo's broad prosperity, focussing on the quality of life here and now, without compromising the prosperity of future generations or that of people worldwide. This concept of broad prosperity is about everything that people consider to be of value, such as material prosperity, health, education, environment and living conditions, social cohesion and personal development.

### **3.4 Relevant niche innovations for the Venlo Green Port Master Plan**

Relevant niche developments for the Port of Venlo greening ambitions include the 19 Port Greening demonstration projects in PIONEERS, see table 1.

Moreover, local energy hub initiatives, circular ecosystem innovations in the agrifood and chemistry system, and innovative hydrogen application projects are relevant niche developments. These initiatives potentially affect the stability of the inland port regime.

Table 1: The 19 Port Greening demo-projects in PIONEERS

PILLAR	ACTION
Clean energy production and supply	Energy generation from water currents
	Hydrogen refuelling infrastructure
	A corridor of modular docking stations for energy containers
	Battery Storage and Smart Management of Green Energy in terminal operations
Sustainable port design	Hydrogen heating for buildings
	Local resource recovery for green, circular concrete
	Electric green last-mile
Modal Shift and Flows Optimization	Green Straddle Carriers
	IT Platforms for planning multimodal transport
	Realizing a modal shift in the commute of port employees
	Cargo Flow Optimisation
	Multimodal access to port using a MaaS platform
Digital Transformation	Cargo Flow Optimisation
	Automated container shuttle solutions for port operations
	Automated vessels
	Vessel traffic optimisation
	Maritime 5G for intelligent vessel location
	Containers transport forecast
Digital Twin	

**4. The relevant climate policies for Venlo’s Green Port Master Plan**

As stated, sustainability policies are expected to have a major impact on the stability of the inland port regime. This chapter elaborates on these legislative and policy developments.

**4.1 Realising Climate Neutrality in 2050 and GHG-emission reduction in 2030**

Under the EU Green Deal package, Europe developed a comprehensive set of policies and regulatory measures aimed at transitioning the EU into a modern, resource-efficient and competitive economy. The EU Green Deal package has to ensure no net emissions of greenhouse gases by 2050, fostering economic growth independent of resource use, and equitable outcomes for all individuals and regions, often referred to as the ‘Just’ principle of the Green Deal. The EU Green Deal includes initiatives on climate, environment, energy, transport, industry, agriculture and sustainable finance, which are closely interconnected. The Green Deal includes the Fit for 55 package, the European Climate Law and a series of accompanying measures and policy strategies.

The Fit for 55 package delineates a pathway towards Climate Neutrality in 2050 with an intermediary milestone to reduce GHG emissions by 55% in 2030, compared to 1990 levels. The EU Climate Regulation made this reduction target legally binding for both EU and the individual Member States. The EU Emission Trading System with a declining absolute emission ceiling facilitates the trading allowable emissions. The EU-ETS is a key instrument to achieve the reduction targets, whilst offering flexibility to the market on how the reduction targets will be realised. Starting with energy-intensive



industry sectors (including energy production), the ETS scope was extended maritime transport and aviation in 2024, with plans for further extension to road transport by 2027, and eventual inclusion of inland waterways and rail transport.

For sectors not (yet) falling under the ETS - like inland shipping at this moment - , the Fit for 55 regulation sets binding annual targets for Member States to achieve GHG reduction targets of 40% compared to the 2005 level. In the Netherlands, the mobility chapter of the Klimaatakkoord specifies the short-term targets for logistics and freight transport. Specific short-term actions until 2024 were agreed upon in the national Green Deal Maritime, Inland Shipping and Ports. Actions include the development of five new business cases for shore-based power for maritime shipping within Green Deal initiative period.

The Fit for 55 package also includes legislative actions to decarbonise fuel in shipping (the FuelEU Maritime initiative) and to realise an accessible and adequate infrastructure network for recharging or refuelling road vehicles or ships with alternative fuels (the Alternative Fuel Infrastructure Regulation – AFIR). The AFIR regulation sets specific targets such as the installation of Hydrogen refuelling stations for cars and trucks in all urban hubs from 2030.

For inland ports, this means industrial activities are probably subject to the ETS (55% reduction compared to 1990), whereas the other port activities including inland shipping are subject to the binding non-ETS targets (40% reduction compared to 2005).

#### **4.2 Policies and regulations accelerating circular economy transition**

In addition to the above measures, the EU developed some accompanying policy strategies. The most relevant one for inland port greening strategies is The European Action Plan for the Circular Economy. This plan implies that a climate-neutral Europe by 2050 will require a decoupling of economic growth from resource use and the move towards circular production and consumption systems. The plan accelerates the circular transition with specific actions around the design of sustainable products, circularity in production processes, extended producer responsibility for recycling targets, and empowerment of consumers and government buyers. The focus is on sectors such as electronics and ICT, batteries, packaging, plastics, textiles, construction and buildings, and food.

The transition towards a circular economy is also accelerated by recent regulations to safeguard our European Strategic Autonomy in terms of availability of critical materials needed for energy transition, defence industry or other critical policy areas. The Critical Raw Materials Act sets specific targets for 2030 concerning the share of mining, processing and recycling of those specific materials to take place within Europe, and limits our dependency from individual non-EU countries such as China.

It is clear that the circular transition will impact freight flows of raw materials, bio-based materials, and recycling logistics for the sectors identified in the Action Plan for the Circular Economy. This offers

opportunities for inland ports to play a pivotal role in the development of future circular logistics networks. See chapter 5 for further elaboration.

### **4.3 Company specific sustainability regulation**

In effect since 5 January 2023, the CSRD is European Union (EU) legislation that requires EU businesses to report on the environmental and social impact of their business activities, and on the business impact of their environmental, social and governance (ESG) efforts and initiatives. Large companies with the requirement to report on non-financial impacts have to comply as of 2024, other large companies will follow in 2025. Stock exchange listed SMEs will follow in 2026. Part of the reporting is the measurement of GHG emissions due to companies' activities, including upstream and downstream supply chain activities, also referred to as Scope 3 emissions. This is expected to have implications for inland shipping operators, intermodal transport operators and freight forwarding companies organising the intermodal transport. Their CSRD-compliant customers need to report on the GHG-impact, also of the transport services they outsource. Consequently, the CSRD regulation will also affect subcontractors and logistics solution providers of CSRD-compliant companies.

This agenda targeting individual companies is being supported by the adopted proposal for a Directive on Corporate Sustainability Due Diligence, establishing corporate due diligence duties and corresponding responsibilities for individual company directors.

## **5. The changing role of inland ports**

What is the relevance of all these policy developments for inland ports? Europe aims to become climate neutral, and the economy as a whole needs to contribute to this objective, including freight transport and inland shipping.

All the abovementioned policy initiatives actively aim at making CO<sub>2</sub>-generating activities more sustainable, impacting the transport sector and consequently also inland shipping. From that policy perspective, ports and inland ports will at least have to facilitate this sustainability task.

There is a lot of momentum in the development of regulations in the field of sustainability, with new regulatory proposals are put forward in rapid succession, but the scope of these proposed regulations is not always clear. The reduction targets suffer from wide array of starting points: absolute numbers versus percentages, different target years and different reference years. For example, the Fitfo55 program aims to reduce CO<sub>2</sub> emissions by 55% in 2030 compared to 1995, while the Green Deal Maritime aims to reduce CO<sub>2</sub> emissions by 20% in 2024 compared to 2015. And within the Climate Agreement, the logistics measures have been translated into an absolute reduction tasks in MTon. For percentage reduction targets, such as the specific reduction target of 30% in 2030 for the continental and hinterland transport segment, it remains unclear what the reference year is. They seem to be based

on the Outlook Hinterland and Continental Freight 2020 study, which takes 2018 as the base year, but that is just an assumption from the authors.

It is also unclear what the reduction target frameworks actually are for inland shipping. Inland shipping does not currently fall under the EU ETS regime, nor does inland shipping fall directly under the ETS2 regime (from 2027 onwards). However, the Dutch government has announced that it plans to bring all fossil fuels that do not fall under the EU ETS under the ETS2 system. Despite the uncertainty, it is clear that CO2 reduction targets will also apply to inland shipping. However, no regulatory frameworks have been outlined for ports and inland ports. This means that ports and inland ports can and may set their own goals, which must of course be in line with the frameworks that apply to the users of the port infrastructure and facilities.

Europe is committed to a climate-neutral economy by 2050. This implies a further reduction of the ceiling values of the ETS, but it also recognizes that this sustainability task requires a transition towards a Circular Economy. The transition towards a circular economy has been further elaborated in the "European Action Plan for the Circular Economy", which is also part of the Green Deal policy. Recently published regulations such as the Critical Raw Materials Act (CRMA) also build on the basic principles of circularity and contribute not only to achieving climate neutrality, but also to an increased strategic autonomy for Europe. The Green Deal package also explicitly takes into account the principle that the transition to a climate-neutral economy - regardless of costs - puts pressure on support for this transition. Europe counters this in such a way that the Green Deal must be implemented fairly ('Just'). In this Green Deal policy and regulatory context there is an opportunity for ports and inland ports to take a proactive course in the circular transition. However, this requires vision development and long-term master planning and road mapping.

## **6. The Venlo Green Port Master Plan approach: Green, Just and Smart**

In this chapter we briefly elaborate the 10 steps of the GPMP approach. This elaboration is mainly based on PIONEERS Deliverable D2.13, the draft GPMP + Roadmap for Port of Venlo (Wijlick, 2022). In PIONEERS, municipality of Venlo and BISCII develop the Green Port Master Plan for Port of Venlo. The process is structured around the following 10 steps:

1. GPMP vision and key objectives;
2. System scoping & system understanding;
3. Stakeholder engagement, policy alignment and GPMP governance;
4. Data gathering and data analysis;
5. Dealing with an uncertain future;
6. Identify and assess pathways, options, and direction (quick scan);
7. Set up a monitoring system to manage and track performance and progress;
8. Quantitative assessment of Master Plan options and directions;
9. GPMP update and feedback cycle;
10. PIONEERS alignment and generalization.

These steps will be further elaborated in the next sections.

## **6.1 Vision, systems scoping and stakeholder engagement**

The first three steps in the approach set the scope. The first step (GPMP vision and objectives) is about sharpening the ambition level, Exemplary questions include: What do we mean with 'Green'? Should we concentrate on carbon neutrality and CO2 reduction or do we articulate a broader definition of green, also including air quality objectives, biodiversity objectives and a proactive role in accelerating the energy transition in general and/or transition towards a circular economy? It is evident that the objective of climate neutrality will have economic and socio-economic impact on the port stakeholders. Also in the GPMP, the economic aspect (value creation) and the social aspect (a just transition) cannot be neglected, following the Triple Bottom Line model, also known as People-Planet-Profit (Elkinton, 1999). In order to achieve these different objectives simultaneously, the vision behind this GPMP is that this can only be achieved by applying novel digitization technologies, labelled as 'smart'. As such, the GPMP can be summarized being Green, Just and Smart.

The second step is about understanding the ecosystem of Port of Venlo, or in terms of MLP framework the Venlo inland port regime. This the role of the port in a broader logistics network including links with major seaports like Rotterdam and Antwerp, but also the role in the network of inland ports (Blueports Limburg), and the regional interactions with the other transshipment terminals and the logistics facilities in the vicinity (Logistics hub Venlo). The systems analysis includes an analysis of the relevant policies on local, regional, national and European scale. The aim is to align the GPMP with economic and socio-economic policies on the different levels. This ecosystem mapping is part of the MLP methodology described in section 2.1.

The Port of Venlo has a wide variety of stakeholders. We recognise the profound impact that sustainability transitions can have on the inland port ecosystem and its stakeholders. The support base of the key stakeholders is crucial in order to realise challenges inherent in such transitions. The stakeholders are mapped and clustered into groups based on the impact and influence the GPMP has on their organization. The inner circle is formed by the municipality and around 45 companies active in the geographic area depicted in figure 1. Amongst them are container transport companies like Hutchison Ports Venlo, CTV and Schenker Logistics, but also industry port companies like MIFA (Aluminium), Geurts-Janssen (steel products), and HKB (Boilers and industrial steam solutions). Stakeholders in the second ring include nearby companies (in one of the Tradeports) that rely on the port for their inbound or outbound logistics. These stakeholders are for instance representative organizations like Supply Chain Valley and Ondernemend Venlo, as well as citizens of Venlo, neighboring municipalities and the Province. A third ring is formed by actors that can play a role in the transition ambitions (e.g. recycling, green energy production or distribution) while a fourth ring of stakeholders have a more indirect interest, like knowledge institutes (Brightlands Campus, Fontys University, Maastricht University etcetera) and interest group representatives like Land van de Makers and NGOs.

The GPMP includes a stakeholder engagement plan, describing when and how to engage these different groups of stakeholders in the process.

## **6.2 Data gathering, data analysis, giving direction, monitoring and assessing GPMP progress**

The second part covers step four to eight of the GPMP approach and has a strong quantitative focus. It all. Step four starts understanding what the current ecological footprint of the Port of Venlo actually is. Standards for ecological footprint analysis for entities that aggregate individual companies, such as port areas, industrial zones or business parks are lacking. What emissions will be included in scope? Moreover, this aggregation level also puts questions on treating so called scope 1-2-3 effects on the level of the port area. How do you cope with transport being executed in the port area and outside the port area? Internal transport within the geographic scope of the port can be rather substantial for a main port like Rotterdam or Antwerp. For Port of Venlo the geographical scope is rather limited and internal transport performance as such rather marginal compared with the port-related transport outside the port area. In the GPMP Venlo the initially focus is on developing an ecological footprint covering CO<sub>2</sub>, NO<sub>x</sub> and Particle Matter. A study commissioned by Municipality of Venlo will deliver this reference ecological footprint in the course of 2024.

In step five, we use foresight studies and aim to apply a scenario analysis to understand the possible future developments and their implications on the inland port regime. The scenario analysis approach builds upon long-term scenario planning for the Port of Rotterdam, with horizon 2050 (Port of Rotterdam, 2022). This scenario analysis is built upon eight external driving forces and six decarbonisation pathways (step 6 of our GPMP approach), resulting in four scenarios with quantification of the corresponding expected transshipment volumes in 2050. The aim in the GPMP Venlo is to translate this study approach to the context of inland Port of Venlo and achieve quantitative scenarios for the transshipment volumes of the Port of Venlo in 2050 accordingly. In this step, we incorporate scenarios on the accelerating power of policy and regulation in the transition pace towards a circular economy, and what that may imply for choices in the circular positioning strategy of the Port of Venlo. In parallel, building upon the elaboration of the key GPMP objectives, we develop KPIs and a measurement plan to monitor the progress of the GPMP. This will be a combination of quantitative and qualitative measurements (step 7).

Finally, in the GPMP process, we anticipate to face more strategic choices for future direction in the scope of the GPMP Venlo. These include choices on attracting typical economic activity in the North Shore Port Development (Gemeente Venlo et al 2022), choices on whether or not to opt for local green energy production, the kind of infrastructure choices to facilitate green transport distribution (e.g. hydrogen hub or battery exchange hub for green vessels). The GPMP can facilitate in these choices with supporting studies and assessing how these options impact the GPMP objectives (step 8). Similarly, the

19 innovative demonstration projects in PIONEERS and similar innovation projects in the sister project MAGPIE could be seen as niche developments that may affect the inland port greening regime.

### **6.3 Adaptive master planning to adopt new insights and generalisation**

The final steps in the approach recognize the need to be adaptive (step 9) and the aim to generalize the Venlo approach (step 10). Greening technologies develop so fast and are still subject to huge levels of uncertainty regarding adoption levels. In order to cope with these uncertainties, the GPMP needs to be adaptive in order to embrace new technological breakthroughs and insights. For this purpose, we built in feedback loops using principles of reflexive monitoring (van Mierlo, 2018). Alternative pathways towards the objectives may therefore become more attractive, which the GPMP should adapt accordingly.

Though the GPMP is applied to the Port of Venlo, the approach is designed and being developed in such a way it could be transferable to other inland ports facing similar challenges. As such, the approach could act as a blueprint example how to approach these transition challenges in a long term strategic way.

## **7. Conclusions**

Europe is in the middle of a climate neutrality transition, accelerated by Europe's Green Deal policy and regulatory package. This Green transition touches upon all industries and sectors, also logistics and freight transport, and correspondingly inland shipping. The role of inland ports is also subject to change. Transition towards circular economy offers new opportunities to inland ports, whereas the national government attitude towards logistics is subject to a wind of change and may require strategic repositioning of logistics. This new reality poses complex strategic challenges on inland ports. Venlo is lucky to have expertise and resources allocated in the PIONEERS project to support this process. In PIONEERS, a ten-step approach has been developed to realise a Green Port Master Plan in order to become climate Neutral in 2050. This approach allows Venlo to proactively steer and guide the strategic choices and decisions needed to achieve climate neutrality in the best possible way. The GPMP approach also aims to give guidance to other inland ports to approach these transition challenges in a similar way, taking into account the specific context of each individual port regime.

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