




Article

Analysing Ways to Achieve a New Urban Agenda-Based Sustainable Metropolitan Transport

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Abstract: The New Urban Agenda (NUA) sets a new vision of sustainable urban development to help cities deal with the challenges of changing demography. While numerous articles have addressed how the NUA can be implemented at different levels and in different areas, this article points out the potential limitations in incorporating the NUA into metropolitan transport policies. The relevance of the limitations can be seen in three main fields: incompatibility between legal and financial frameworks and the functional and spatial structures of metropolitan areas, the characteristics of how transport systems are developed as part of metropolitan functional and spatial structures and the inconsistency and inadequacy between political declarations (NUA) which are based on ideas and programmes and the objectives of strategy papers which are based on diagnoses, data analyses and predictive models. The authors put forward the thesis that by concentrating on cities, the NUA leaves out some of the characteristics of metropolitan areas. As a consequence, although the NUA can work successfully for metropolitan cores, outer areas are not covered directly. In order to verify the thesis, a comparison was made between the NUA's transport system approach with experience from running and planning metropolitan transport systems described in the literature. The results of the comparative analysis, confirmed the thesis of the authors and made it possible to formulate general conclusions regarding the specific conditions of metropolitan areas for the running and developing of the transport system. By using explanatory case study of Tri-City Metropolitan Area (TMA) and the Strategy for Transport and Mobility for TMA 2030 general assumptions were confirmed and explain in more details. The NUA and STM were compared for how they address the main areas of intervention related to transport. Differences were identified and recommendations were formulated, should the documents be updated. The STM must be updated in areas such as equity and climate change mitigations while the NUA should be expanded to cover the specific conditions that prevail in functional and metropolitan areas.

Keywords: new urban agenda; metropolitan transport system; civil engineering and transport

1. Introduction

More than 50% of the world's population lives in urban areas, a large part of it in metropolitan areas. It is predicted that by 2050 70% of the population will live in urban areas [1]. In this situation, it is questionable if the cities are sufficiently equipped to keep pace with this demographic pressure. To give an answer to the massive global trend in urbanization in October 2016 the III United Nations Habitat Conference was held where the New Urban Agenda (NUA) was approved [2].

The NUA is serving as a new vision for the cities and municipalities for the next 20 years. This document sets a new global standard for sustainable urban development and helps to rethink how life in the cities can be planned and managed. The NUA aligns with the 17 key Sustainable Development Goals (SDG) related to urban development, quality of life and social equity. The main areas of NUA refer to specific targets of the SDG's goal No. 11 which is: "to make cities and human settlements inclusive, safe, resilient and sustainable" [3]. Transport and mobility are key issues for achieving the goal. Reflecting the complexity of urban structures, the new agenda covers a broad set of topics, where transport and mobility find their place or interact with: other technical infrastructure, urban planning, public space, housing, land use, real estate, energy efficiency, cultural heritage, good governance, regional cooperation, inclusion, equality, gender issue, anti-discrimination, participation, education, health, economy, industry, resilience, disaster risk reduction and financing.

The language used in the document is flexible and supports the delivery of the vision in many areas and contexts [4]. With no legal force, the NUA is merely a declaration designed to express a joint position of the stakeholders. Despite that, it does create a language in which urban issues and the urban developments over the coming decades will be discussed. The implementation of the NUA helps facilitate the achievement of other development agendas, policies, plans, approaches and actions in the urban context in general [4] or sectoral terms [5] on regional [6,7], national [8] or local level [9] both in developed and developing countries [10].

The NUA's European delivery instrument is the Urban Agenda for the EU, approved in 2016 under the Pact of Amsterdam [7]. Partnerships have been launched under the Urban Agenda for the EU involving city authorities, member states, EU institutions and other stakeholders. Their goal is to provide citizens with new opportunities, improve their quality of life and deal with the key challenges that cities must face, including transport and mobility issues.

On the national level the NUA proposes National Urban Policies (NUPs) within local-national partnerships as one of the fundamental drivers of change, including transport and mobility. The NUP is a key instrument for governments to support the implementation of the NUA, city related SDGs and other global agreements such as the climate change agreements. A report of the OECD [10] shows that European countries still have a lot to do to develop NUPs. Only eight countries have an explicit national urban policy and the next eight have partial elements of national urban policies in their urban policy landscape, offering some foundations on which to build on. Poland adopted its NUP in 2015 elevating it to the level of national strategy papers. With the NUP part of the hierarchy of documents, more consistency is expected in linking thematic development goals with lower levels of administration (region, municipality, city).

At the lowest level of administration, urban areas have been given a tool to achieve sustainable urban mobility. This comes in the form of the European Commission's proposed Sustainable Urban Mobility Plans (SUMP), a strategic document designed to meet the demand for mobility whilst ensuring adequate quality of life for the residents [11]. The concept of SUMP, as the document to implement SDG No. 11, has been widely adopted in Europe over the last years. Today, two of the cities that form the TMA, that is, Gdańsk [12] and Gdynia [13] have already adopted their SUMPs with Sopot still working on the process.

A system of strategic documents with known formal and legal ramifications corresponds to the country's fundamental territorial division. In many countries administrative divisions do not reflect settlement processes as they happen. Recent decades have seen the rise of polycentric metropolitan regions consisting of a number of connected large urban areas, which presents a new set of challenges for transport planning [14]. New functional and spatial trends call for a metropolitan approach to governance and new legal and financial frameworks. This is reflected in the NUA [2, article 90] and emphasised in IRU's publication [14]. Many countries, however, do not have metropolitan governance frameworks in place. The result is a variety of informal structures of cooperation between the relevant bodies [15–20].

Metropolises come in different sizes, spatial forms and degrees of advanced metropolitan processes. In Poland, Warsaw is the only city which may qualify as an established metropolis, although at a low level when compared to international standards. Apart from Warsaw, other cities with

populations of more than half a million have fairly well developed metropolitan functions. They are Poznań, Wrocław, Kraków, the Tri-City and Silesia Conurbation and Łódź. [21]. The functional and spatial development of Polish metropolises follows the world's trends. There are monocentric metropolises with a single city and polycentric metropolises such as the Silesia Conurbation and the Tri-City. The morphological differences carry functional consequences due to different types of transport links (Figure 4). The common feature is a growing demand for longer and more complicated technical infrastructure networks including the transport network.

Dedicated metropolitan governance is common in Poland. Four of the eight metropolitan areas in Poland (Łódź, Wrocław, Poznań and the Tri-City) have metropolitan governance bodies. In Krakow and Wrocław the voivodeship, the first level of sub-national government, provides some of the functions of a typical governance body [15].

Regardless of what type of metropolitan governance has been adopted, strategic papers are developed to support the delivery of metropolitan functions. The new classification of metropolitan functions proposed in "Metropolitan areas in Europe" [22], puts transport next to politics, economy, science and culture. Transport is indicated as a key challenge for metropolitan governance by Barcelona Centre for International Affairs [23] too.

While EU countries commonly plan their strategy papers around the paradigm of sustainable development, "planning lacks unifying themes or directives for achieving sustainability in cities (. . .) The existing rating systems can be context-specific by country and may at best target weak sustainability as their intended outcome" [4]. Therefore, it seems reasonable to seek answers to how the New Urban Agenda aligns with strategic planning of infrastructure and cities but also at particular levels of territorial division.

Because they are designed to promote new ideas, political declarations such as the NUA, set the main goals and directions for sustainable development and non-discrimination policies. They also relate to the relevant science and research. The literature presents debates on sustainable development which can be divided into a few themes: a) conceptual; b) contextual; c) academic; and d) geopolitical [24]. A review of the literature shows that research and development interests concentrate on sustainable development goals, the results of decisions taken, proposed sequences of actions, the tools used and ways to measure results [4,24–28]. The objective of this article is to enrich the knowledge on how to plan and implement sustainable development effectively by identifying potential inconsistencies and inadequacies of the political declarations (NUA) which are based on ideas and programmes and the goals contained in strategy papers which are formulated on the basis of diagnoses, data analyses and predictive modelling. If formalised and dedicated to a strict delivery of political declarations, the inconsistency may hamper the delivery of strategic targets or even cause organisations to abandon the goals altogether. This constitutes a methodological error and one that stems from failure to acknowledge specific aspects of sustainable development policy which may be a consequence of a country's social, economic and political ramifications [10]. As suggested by the author [10] Poland's fundamental administrative division at city level may find it difficult to implement the New Urban Agenda successfully "in the conditions of constantly changing law, lack of proper financing and organizational problems that Polish cities have to face" [10].

2. Method

2.1. Study Method

Having developed the Strategy for Transport and Mobility for the Tri-City Metropolitan Area our team realised that metropolitan areas are not addressed directly by the NUA and that the specific needs of metropolitan areas and their transport systems are not accounted for. The overall objective of the work was to establish whether:

- the NUA's proposed approach to urban visions, principles, implementation and follow-up and review can be successfully used in metropolitan areas?
- the NUA's proposed principles can be used for planning metropolitan transport systems?



To achieve the main goal two groups of specific research objectives were adopted: scientific and practical. The scientific objective was to analyse how well the NUA corresponds to previous experience and principles of transport planning in metropolitan areas. The practical objective was to formulate recommendations to both documents in the main areas of intervention covering the operation and development of the urban (NUA) and metropolitan transport system (STM). The objectives were achieved by using a set of methods as schematically presented in Figure 1.

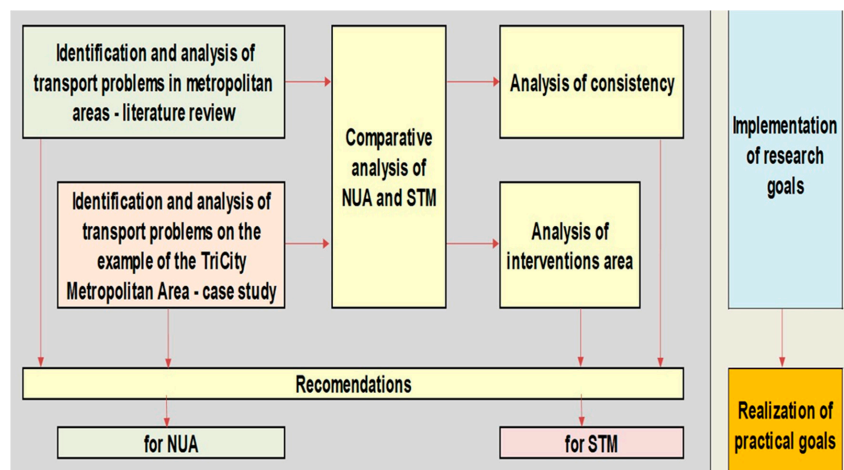


Figure 1. Diagram of the method for achieving scientific and practical objectives.

2.2. Achieving the Scientific Objectives

To achieve **the scientific objectives** the authors of this article used three study methods: literature review, case study and comparative analysis.

Literature review was designed to identify and analyse transport problems in metropolitan areas to use as the basis for answering the following questions:

- RQ1. How are transport and population mobility problems represented in the NUA?
- RQ2. What is the transport management experience in metropolitan areas?
- RQ3. What transport problems are found in metropolitan areas?

Literature studies looked at NUA implementation experience [6,29,30], the research methods applied [24,27,28] and the identification of metropolitan transport problems [31]. A few dozen scientific publications were studied such as [16,25,32], reports from NUA implementation, for example [5,8] and case studies, for example [4]. The answers to scientific questions one (RQ1), two (RQ2) and three (RQ3) are presented in Section 3.

Case study included identifying and analysing transport problems using the example of the Tri-City Metropolitan Area (TMA). The authors first characterised the TMA and its transport system and presented its strategic document titled Strategy for Transport and Mobility in the TMA until 2030. Next, studies and analyses were conducted to help answer more research questions:

- RQ4. What are the differences in delivering transport services in the TMA's core and outer parts?
- RQ5. What are the problems in delivering transport services in the TMA's outer part?

The answers to the question four (RQ4) and five (RQ5) are provided synthetically in Section 4. A number of analyses and studies were conducted. Results of TMA's diagnostic studies were used such as: analysis of planning documents [13,33], transport system stocktaking, road traffic studies (in the field), transport behaviour of the population (surveys) [34,35] and transport services by different transport modes (database exploration) [33,34,36]. Simulation studies were also conducted for various options and scenarios [11,24] of TMA's transport system operation. The simulation studies covered

the core and outer sections and a combined area of the entire TMA. The simulation was aided by a transport model which was developed using the VISUM software [37]. Calibrated to in-the-field and survey data, the programme was applied to cars and public transport [34,38].

Comparative analysis involved a comparison between how the NUA solves transport problems and how this is addressed in the STM in the area of the TMA. The results were intended to help the authors to answer the following questions:

- RQ6. Is there consistency between the NUA's principles of shaping metropolitan transport systems and the TM's goals and programmes of action?
- RQ7. Do the NUA and STM cover the same areas of intervention used for managing and developing transport systems in metropolitan areas?

The comparative analysis used the results of analyses from Sections 3–5. Section 5 gives the results of the analyses and the answer to the question six (RQ6) and seven (RQ7).

2.3. Achieving the Practical Objectives

The authors delivered the practical objectives of this article by analysing and synthesizing studies and analyses presented in Sections 3–5. The results of the analyses are intended to help with these practical questions:

- PQ1. Which of the areas of metropolitan transport intervention identified through literature studies and case studies should be included in the NUA?
- PQ2. Which of the areas of intervention proposed in the NUA and identified in the studies should be included in the TMA's development efforts (e.g. the STM)?

The recommendations which answer the above questions are given in Section 6.

3. Identification and Analysis of Transport Problems in Metropolitan Areas—Literature Review

3.1. Transport and Mobility According to the NUA

As well as playing its original and primary role, that is, moving people and goods, transport may help to integrate a region, build its competitive advantage and stimulate economic growth (including the creation of new jobs). The NUA makes frequent references to transport in multiple contexts and places (Figure 2) which led to a synthesis of transport and mobility topics conducted within the NUA's chapters.



Figure 2. Transport-Relevant References in NUA.

The NUA's vision of a sustainable city meeting its social, economic and environmental functions includes the need for equal access to a sustainable and safe for all urban mobility. It talks about resource efficiency in using passenger and freight transport systems to effectively link people, places, goods and economic potential. It puts emphasis on a high quality of transport services and equal access regardless of gender. Mobility management should contribute to promoting sustainable consumption patterns which mitigate the effects and adapt the transport system to climate change. As regards metropolitan governance the NUA talks about the need to take advantage of opportunities presented by today's and tomorrow's sustained, inclusive and sustainable economic growth. In its vision cities fulfil their territorial functions across administrative boundaries and act as hubs and drivers for balanced, sustainable and integrated urban and territorial development at all levels.

The “Principles and commitments” chapter defines how the vision should be delivered through shared approaches. Key to this is sustainability and a people-focused, integrated approach to urban and territorial development by implementing policies, strategies and actions at all levels. By promoting cooperation across all levels of administration, urban areas will grow in a sustainable and integrated manner.

“Call for action” is the biggest chapter identifying how cities should work to be sustainable. So for the purposes of this analysis the NUA’s approaches to actions have been grouped into three main pillars of sustainable development. As described in the paradigm of sustainable development transport should be socially acceptable, economically justified and environmentally safe. A closer look at the “Call for actions” chapter shows that sustainable urban transport should meet the following requirements:

- social—exercising the right to an adequate standard of living, without discrimination, a common and equal access to high quality mobility and transport infrastructure and services. Urban mobility which is safe and accessible for all and efficient. Efficiency is to be achieved through integration of subsystems and shaping transport behaviour, developing a well-organised, safe and functional system of public transport and by promoting active forms of mobility such as walking and cycling. If transport safety is to improve, legal changes will be required as well as new planning and technology approaches to focus on road safety and vulnerable road users.
- economic—the ability to move people and goods using a fast, efficient and cheap transport is the most important element of meeting the EU’s goals which is to combine a dynamic economy with social cohesion. According to NUA guidelines urban mobility and transport should contribute to an effective use of an area’s economic capacity going beyond the city’s administrative boundaries and stimulate interaction and connectivity between urban and rural areas. The NUA includes a number of political declarations designed to support the application of international and national public finances to advance urban and territorial sustainable development.
- environment—the NUA puts emphasis on the need to minimise the human impact on the environment through transport. To that end it encourages a change in transport behaviour, new low-carbon and energy efficient technologies and optimisation of transport choices. The document reflects the growing understanding of global threats, a result of climate change. The NUA points out that more needs to be done to prevent further climate change.

Signatories to the NUA use the “Effective implementation” chapter to commit themselves to actions for creating legal and financial frameworks at all levels of governance and working towards cooperation and participation. The document promotes a clear division of competences of territorial units and encourages cooperation between them while leaving cooperation principles to be defined and regulated by national laws. Given the functional and spatial differences of metropolitan areas, the NUA encourages the development of sustainable regional infrastructure to stimulate sustainable economic production, promoting equitable growth of regions across the urban-rural continuum. The declarations refer to support for integrated territorial planning to prevent unfavourable and uncontrolled urban development trends. Spatial planning should follow the principles of compactness, polycentrism and multiple use of space which will help to reduce the challenges, needs and costs of service delivery per capita and harness density and economies of scale and agglomeration. There is a declaration for transport safety.

“Follow-up and review” includes incentives and declarations for a timely and active implementation of the NUA and monitoring progress, evaluating the impacts and reporting regularly.

Described in the document, the urban vision talks about cities which fulfil their territorial functions across administrative boundaries and act as hubs and drivers for balanced, sustainable and integrated urban and territorial development at all levels. But the vision, commitments and principles of implementing a sustainable transport system are primarily related to areas within cities and concentrate on urban trips with a marginal interest in external trips, the basis for economic growth and prosperity of metropolitan areas. These conclusions are a positive answer to the research question one (RQ1).

3.2. Experience of Transport Operation and Management on Metropolitan Areas

Metropolisation is one of the key features of today's development model. In the contemporary world developed countries maintain contacts between regions through their metropolitan areas with links that include transport and institutions. There are several cities in Poland that have established a presence on the European map of metropolitan cooperation such as the Tri-City's seaport cities.

In spatial terms a metropolitan area is a region consisting of a densely populated urban core and its less-populated surrounding territories, sharing industry, infrastructure and housing. Metropolitan areas include one or more urban areas, as well as satellite cities, towns and intervening rural areas (Figure 3) that are socioeconomically tied to the urban core, typically measured by commuting patterns. Analysis of Poland's transformation processes suggests that metropolises grow faster than the regions they are in. The gap between cities and their surroundings increases.

With an uneven level of development, metropolitan areas are prone to social inequalities in terms of employment, income and access to goods and services [19]. When viewed in this context, transport systems should encourage active and inclusive approaches and prevent social exclusion. The right to mobility should not depend on social or financial status. An affordable and good quality public transport system should help to deliver these objectives [2]. Metropolitan transport systems face an additional social challenge which is the right to clean air, a condition which dense development and a high concentration of travel destinations to metropolitan cores put at a serious risk. This should be addressed, especially in core areas, by swapping the car for public transport and using active forms of mobility [19]. In surrounding territories, the priority is to ensure accessibility and mobility to prevent social exclusion. Because public transport services in an extensive spatial development pattern are not as good as in highly urbanised areas, non-public transport and the car take centre stage [39].

Metropolises attract new residents [40]. Population growth causes metropolises to expand their territories, a result of sub-urbanisation mostly. The majority of metropolises follow a similar global pattern as they grow. On the one hand a globalised construction industry offers everyone similar architectural patterns and on the other metropolises produce their own social structures and life styles. Metropolises and their areas differ in how big and concentrated they are and how strong the mutual links between urban areas are. (Figure 3) [41].

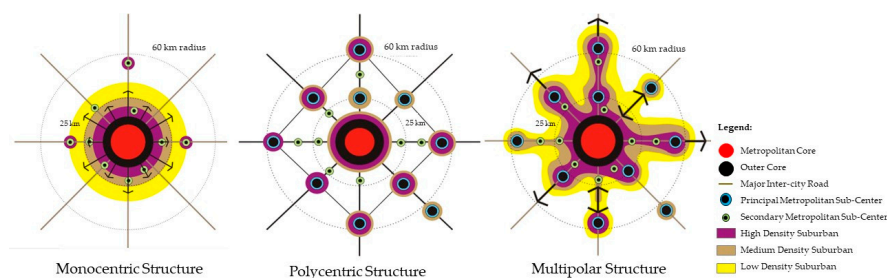


Figure 3. Models for spatial structures of metropolitan areas. Source: Edward Leman, Chreod Ltd, 2001 reproduced in *Metropolitan Governance: A Framework for Capacity Assessment* [17].

As a settlement system metropolitan areas consist of a number of settlement units and highly urbanised areas. They include zones significantly affected by daily impacts (jobs and homes), development areas and a well-developed transport infrastructure. Some of the area becomes part of national and international links, cooperation and relations [20]. The result is a transport system which provides access to the metropolitan area and by the same token, strengthens its capacity for better metropolitan functions. As well as linear elements (a network of motorways and express roads, trunk rail lines), the Trans-European Transport Network (TEN-T) supports the development of metropolitan transport hubs of domestic and international significance which generate substantial passenger and freight traffic. In the case of coastal settlement patterns, transport hubs such as sea ports, airports, ferry terminals and train stations help to further develop metropolitan public space. The majority are located

within the metropolitan core generating strong influences on its spatial structure and environment and contributing to intense transit traffic [42].

The morphological differences carry functional consequences due to different types of transport links (Figure 4). Mono-centric metropolitan regions face traffic and transportation problems due to the concentration of the population in one core city while poly-centric metropolitan regions face necessity of transport links between the centres [18]. With the sprawling nature of metropolises, fragmented space and separation of places of work, residence and services metropolitan populations tend to move about more. This means having to organise an increasingly complex system of car traffic and public transport [43]. In the last decade or so western countries have seen their metropolitan populations triple their mobility. Until not long ago a person living in a western metropolis would cover an average of three kilometres daily only to see it soar to 10 [21]. Trips for work, shops and culture are now taking longer. This calls for a new way to manage the growing and more complex urban organisms and their hinterland [19].

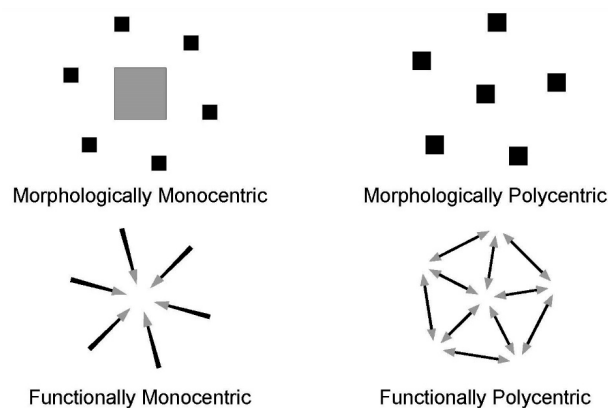


Figure 4. Morphological Poly-centricity versus Functional Poly-centricity. Source [41].

Regional populations make daily trips within their functional areas and between them (Figure 5). Inner trips are highest in cities which are regional cores. Because they have a high concentration of jobs, schools, services and leisure, cities like these generate a lot of traffic with people coming from outside the cities on a daily basis.

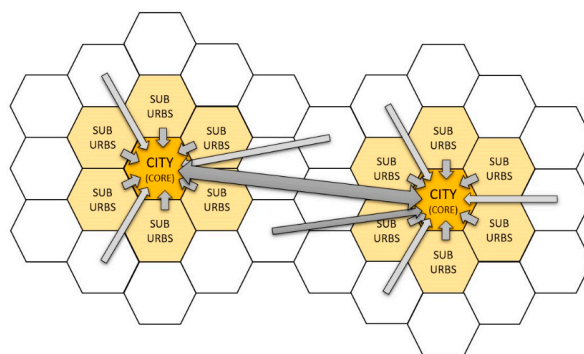


Figure 5. Main trip directions in metropolitan areas. Source: own work.

The conditions determine people's transport behaviour and there are major differences between how those living in the metropolitan core and those outside it travel. [39]. Metropolitan core residents make more trips during the day, a result of better access to trip destinations such as shops, restaurants and entertainment which are not far from where people work, live and learn. Areas outside the core have poorer accessibility with trips having to cover longer distances meaning more time which eventually leads to fewer trips.

With lower population density outside metropolitan cores, public transport services are less developed for economic reasons. Poor access to public transport makes an area less attractive leading to fewer trips [43]. The specificity of metropolitan trips, that is, longer distances and longer travel times, means that walking and cycling only represent a small proportion of all travels. This leaves the car as the most common and easily available means of transport [39]. As a consequence, road traffic is heightened on access roads to cities making inner city networks even more congested.

Running a metropolitan technical and social system requires new methods and institutional setups. For years many countries have been working to establish governing bodies where metropolitan areas can be managed regardless of legal and administrative divisions [21,44]. There is an urgent requirement for all metropolitan areas to establish integrated urban transport planning authorities with the target to overcome fragmented and often unfocused planning by the previous multilevel horizontal and vertical authorities. Governance models seek regional solutions through horizontal, flexible and coordinative mechanisms [16]. Faced with a lack of regulation, Polish cities and municipalities have been working together on a voluntary basis aiming to deliver jointly specific communal functions. Units of metropolitan areas sign agreements and establish inter-municipality associations to allow them to deliver integrated services as set out in the local authority act. Organisational and financial problems emerge, however, especially in conurbations comprising a number of municipalities of varying size. The analysis carried out was an attempt to answer the research question two (RQ2).

3.3. Identification of Characteristic Features of the Metropolitan Transport System

The literature review helped to identify the characteristic features of how metropolitan transport systems can grow in terms of spatial structure, infrastructure, management and social and traffic conditions.

Metropolitan areas are typically home to supra-regional and international facilities and services such as ports (sea ports and airports), industry and higher level functions, that is, economic, scientific and cultural. The presence of metropolitan functions and functional and economic links requires connectivity using air, rail and road transport. As they grow and develop metropolitan areas must invest in access infrastructure.

Another feature of a metropolitan area is its varying intensity of development ranging from highly developed cores to less densely developed surrounding areas. The core can be made up of a single or multiple urban centres. The surroundings are usually less urbanised and populated causing them to resemble suburban or rural areas. Transport priorities also differ from area to area. Social and environmental aspects cause cores to change their modal split and put more emphasis on public transport and active forms of mobility as suggested in the NUA. Where spatial development is extensive the provision of public transport service cannot be as good as that in heavily urbanised areas. As a result, transport infrastructure will follow different objectives and actions. As an example, cycling in the core area will be promoted as a mode of transport while areas outside the core will aim to increase the role of cycling in conjunction with regional means of public transport. Provision of adequate infrastructure is the primary factor of ensuring transport services, safety, mobility and prevention of social exclusion.

Considering the differences between core areas and surrounding areas in terms of their traffic, social and infrastructural conditions, the authors formulate a thesis that while the NUA can be successfully applied to metropolitan cores, it cannot be applied directly to outer areas. The conclusions from this analysis are the answer to the third research question.

4. Identification and Analysis of Transport Problems in the Tri-City Metropolitan Area—Case Study

4.1. Tri-City Metropolitan Area (TMA)

With a mismatch between the territorial and administrative divisions and the actual spatial and functional characteristics, conurbations and metropolitan areas have to come together to jointly resolve their functional and development problems. Having that shared goal which is to ensure a harmonious growth of the entire Tri-City metropolitan area, was the driving force behind the establishment of an association of counties and municipalities. Set up in 2011, the organisation brings together the authorities of some fifty local authority units, all part of the Tri-City Metropolitan Area. Under Poland's legislation such associations are voluntary because the law does not regulate metropolitan areas, their formal and legal establishment, operation or funding.

Located in the north of Poland, the Tri-City Metropolitan Area (TMA) with the Tri-City (the cities of Gdańsk, Gdynia and Sopot) (Figure 6) at its core is made up of eight counties and three county capitals. The area has a population of 1.5 million. Its metropolitan transport functions are delivered primarily by the TEN-T's trans-European network infrastructure (sea ports, airport, rail, express roads and motorway), national and regional roads and rail lines. The TMA's internal transport services between counties and municipalities are delivered by the remaining transport infrastructure.

Key to assessing the TMA's spatial structure from the perspective of transport is the area's long-lasting process of sub-urbanisation, urban location of sea ports, their hinterland industries and services and a strong presence within the TMA's core of places of higher education and jobs. According to the models for metropolitan area spatial structures proposed in Reference [17] the TMA corresponds to the asymmetrically developing Multipolar structure (compare Figure 3).

As sub-urbanisation progresses, average trips take longer. The share of cars in TMA trips increases as a result of infrastructure shortages, poor connectivity between transport modes, slow pace of adding new transport hubs, insufficiently integrated ticketing systems, bicycles not sufficiently recognised as a means for commuting to transport hubs, poor access to public transport in areas outside the core TMA and poor quality of transport services operating between the Tri-City and the other TMA municipalities.

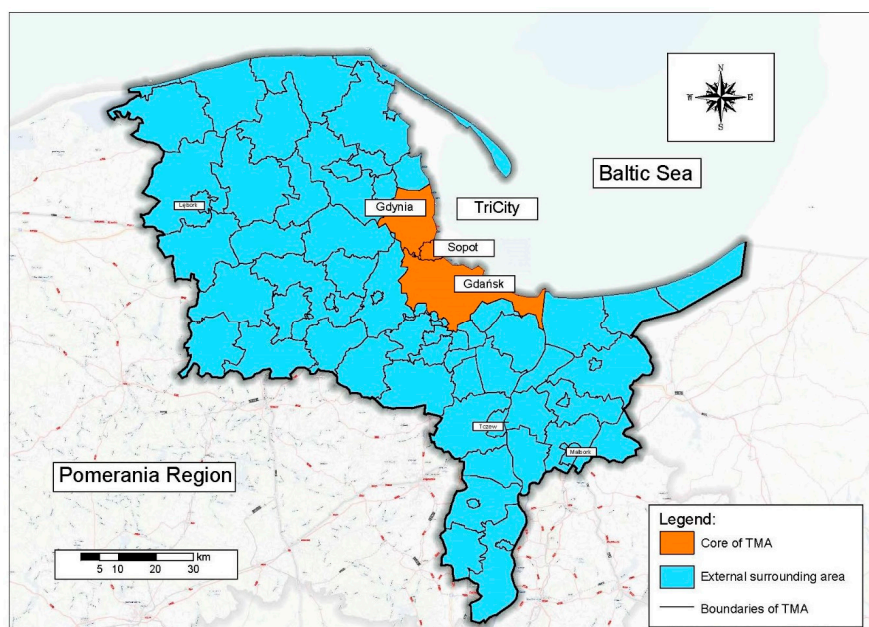


Figure 6. Tri-City Metropolitan Area. Source: [34].

4.2. Strategy for Transport and Mobility for the TMA

The framework of cooperation for the area's transport mobility issues is the TMA's Strategy for Transport and Mobility (STM TMA). Adopted in 2016, from the methodological standpoint the STM TMA includes: a diagnosis of the existing transport system, a vision, development scenarios, strategic goals and programmes for delivering those goals. With references to standards of strategy development, the methodology can serve as good practice. The transport system's diagnosis addresses the following problem areas: determinants of trips and transport behaviour, identification and assessment of transport infrastructure for its condition, cohesion and accessibility, a transport safety assessment, especially that of road transport and the impact of transport on the environment and the quality life of the people. A Complex Traffic Survey (CTS) was conducted designed to study traffic volume and vehicle speeds, modal split of vehicles and freight, directions of passenger transport and means of transport, destinations, reasons why specific modes are used and others. The CTS' main goal was to build a traffic model for further use in planning to forecast changes in traffic for the different transport policy scenarios [45].

Key to the methodology was to define strategy scenarios to reflect the STM's different internal and external factors (Table 1). Its sustainable transport and mobility option relies on a good socio-economic situation as measured with GDP and promises prosperity for all and a highly effective transport policy. As much as they are unfavourable, the other strategy scenarios sadly turned out to be realistic.

Table 1. Potential transport scenarios in the STM. Source [34].

| Factors Impacting on Scenarios | | Social and Economic Situation Measured with GDP | |
|-----------------------------------|------|---|---------------------------|
| | | bad | good |
| Effectiveness of transport policy | low | Stagnation scenario | Pro-motorization scenario |
| | high | Restrictive scenario | Sustainable scenario |

The TMA's basic goal to be met through its transport system is to support the delivery of the area's social, economic and environmental objectives defined in the relevant regional and municipal strategies. High quality standards are required if the transport system is to be competitive, support social engagement and economic innovation, promote spatial order and sustainable urban mobility.

The STM's actions and interventions are related to areas: external/surrounding area (A) and internal/core area (B). External interventions (A) are designed to ensure the TMA's external connectivity to support its position as an international hub. There are two strategic objectives within this area:

- A.1. Improve the TMA's transport accessibility,
- A.2. Improve the quality of transport infrastructure to ensure access to the TEN-T's sea ports and airports.

Internal interventions (B) are designed to ensure the TMA's internal (between municipalities) connectivity to support its development as a functional area. There are three strategic objectives within this area:

- B.1. Improve efficiency of TMA's transport networks,
- B.2. Improve public transport and non-motorised services,
- B.3. Reduce adverse impacts of transport.

To ensure that the strategic objectives are delivered successfully, strategic interventions will be part of programmes of joint and coordinated actions. Defined as joint, these actions will be taken by at least two municipalities and involve organisations from outside the local authorities. There are six key programmes of cooperation in the STM with each delivering their specific strategic goals (Figure 7) through specific objectives.

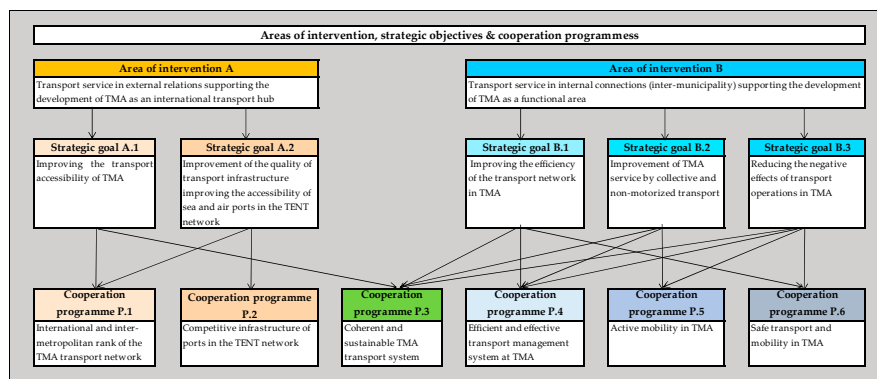


Figure 7. Diagram of links between strategic goals and programmes of cooperation in the TMA until 2030. Source: [34].

4.3. Identification of Characteristic Features of the TMA Transportation System

To illustrate and quantify the defined characteristics of how metropolitan transport systems develop (Section 3), the TMA was used as a case study along with data from Diagnosis, a document developed as part of the STM. The areas selected involve transport infrastructure, spatial structure, social conditions, mobility, levels of activity, length of trips and transport system management in the face of no legal or financial regulations to support inter-municipality cooperation.

4.3.1. Transport Infrastructure

In the case of the TMA, its key external links include inter-regional, inter-metropolitan and international routes primarily with TEN-T hubs such as the sea ports of Gdańsk and Gdynia and the airport in Gdańsk. The quality of their infrastructure is decisive for how accessible externally the TMA is which translates into how competitive the area is compared to other Polish and Baltic region's metropolitan areas. As well as carrying freight, the links are also important for the supra-local system of rail, bus and air transport (Figure 8.).

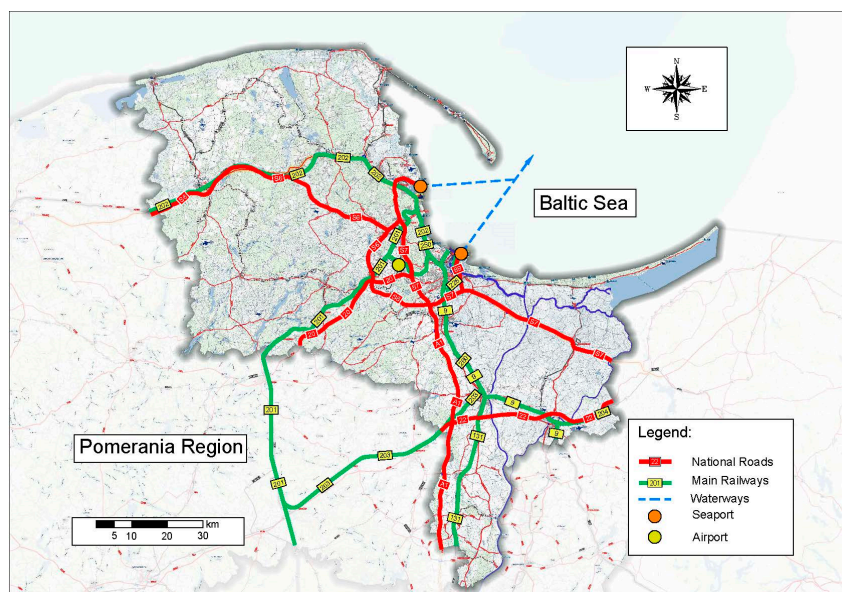


Figure 8. Regional and inter-regional transport links within the TEN-T. Source: [34].

As regards the TMA's internal trips, the priorities for the transport infrastructure are as follows:

- Rail and bus network to operate inter-county links; in the model the system's basic structure is made up of rail lines connecting into shuttle bus services.
- Cycle network to operate on local links and provide access to B+R transport hubs.

At present, if the sub-systems are to grow and offer a good service, the road and rail infrastructure must improve. This means having to plan for the necessary expenditure in development programmes and financial plans.

As explained in the STM the metropolitan transport system should support metropolitan and supra-metropolitan trips in conjunction with national, regional and county transport and road authorities. Municipal trips, however, are part of the local authority remit. This puts TMA authorities in a position of limited power with joint efforts, setting standards and good practices as their only tool. Metropolitan trips, the subject of the STM (inter-municipality trips within the TMA) in 2014 represented 24% of all TMA trips with supra-metropolitan trips at just 3% of all trips.

4.3.2. Trips within the Metropolitan Area

The case of the Gdańsk-Gdynia-Sopot Metropolitan Area confirms the transport behaviour and traffic flows as presented in the previous sections. As regards trip destinations, it is clear from study results that the majority of trips within the TMA are related to the core and smaller towns (Tczew, Łębork, Malbork). The highest number of trips is made within the core. Given the specificity of the TMA with its three cities aligned along a linear spatial system, trips within the core are longer on average (10 km) compared to other metropolises that radiate from the centre (about 7 km) [34]. As we know from a study of metropolitan trips, the core has a strong impact on trip distribution and is the main destination of inter-municipal trips regardless of the motivation (Figure 9).

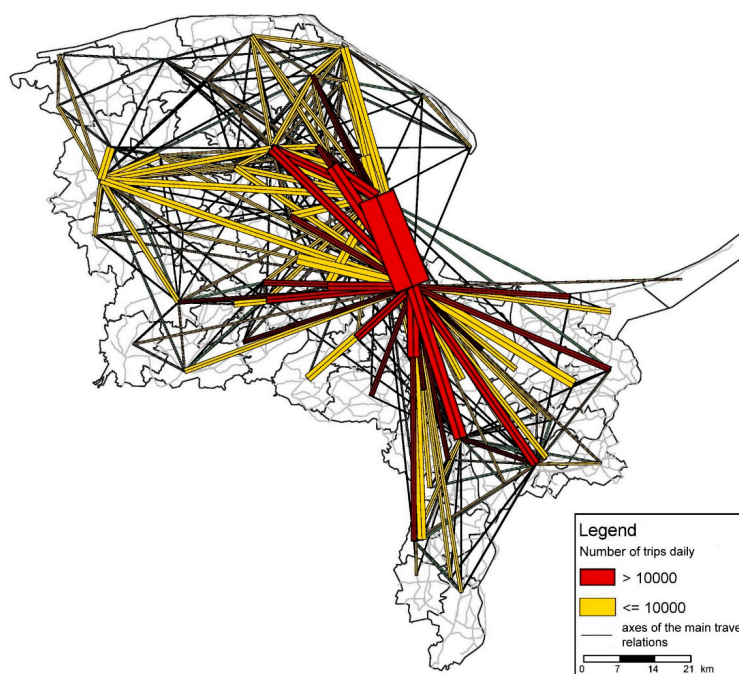


Figure 9. Trip distribution in TMA on a typical day. Source: Own work.

The asymmetry of the multipolar structure caused by the metropolitan core's decentralised location (the north-east end of the region) makes it difficult to provide transport services for travellers. As a result, access to the core from the other parts of the metropolis is constrained. A substantial part of the metropolis (about 30% of the area) is outside the core's 60-min travel perimeter (Figure 10).

This situation is a challenge for planners whose aim is to develop the metropolis and prevent social exclusion which may lead to poverty and depopulation.

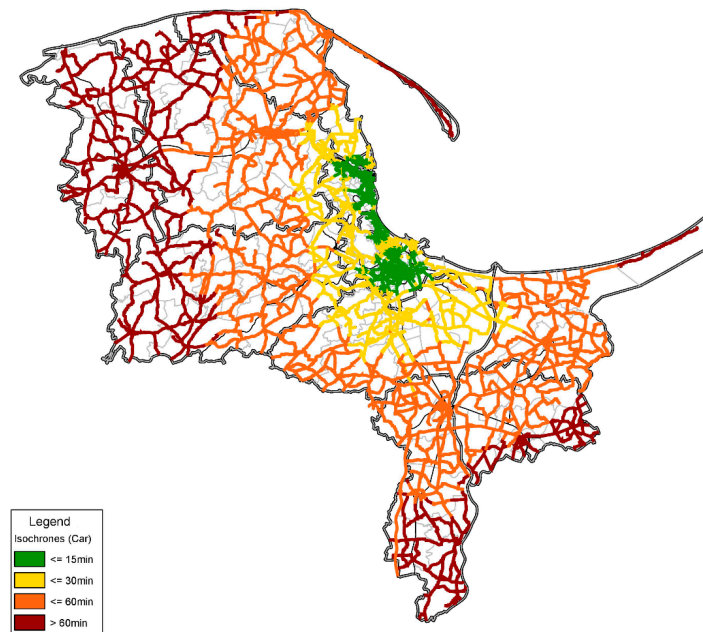


Figure 10. Isochron of travel time to the Tri-City’s city centres. Source: own work.

4.3.3. Modal Split

Set out in the STM, the transport infrastructure objectives suggest a need for a specific modal split across the metropolitan area with public transport and car trips each maintaining a specific share. The size and intensity of spatial development translates into a varying share of public transport which differs from zone to zone and depends on trip length (Figure 11). The forecasted modal split will also change as a result of one of the scenarios envisaged in the transport strategy for the TMA. If overall trips increase, public transport share will be the lowest in the pro-motorization scenario and the biggest in the sustainable scenario. On a metropolitan scale the divisions differ clearly from those in the TMA’s central cities (Figures 12 and 13).

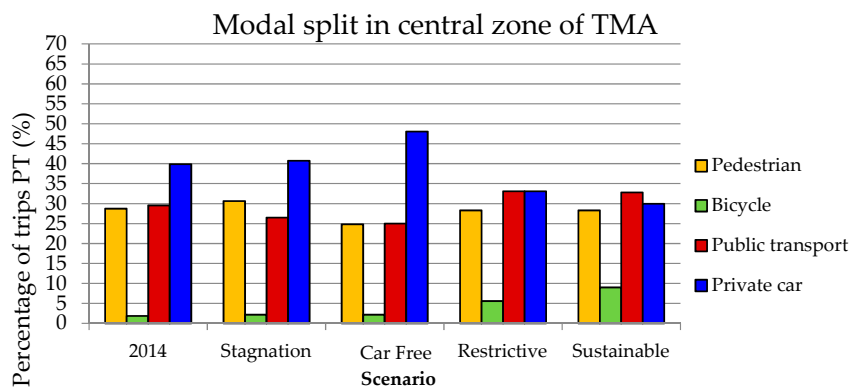


Figure 11. Existing (2014) and forecasted modal split of trips in the TMA’s central zone in 2030 for the particular STM development scenarios. Source: [34].

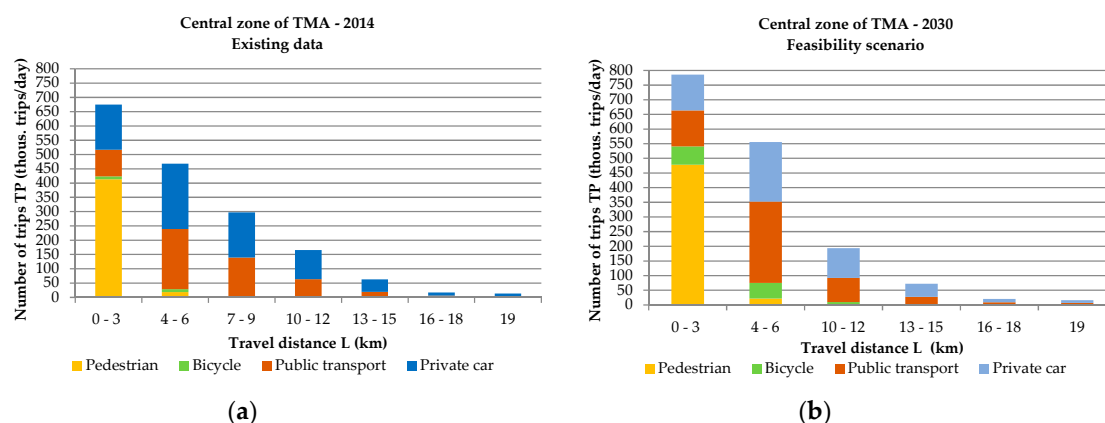


Figure 12. Modal split of trips due to length of trips (a) in 2014, (b) in 2030. Source: [34].

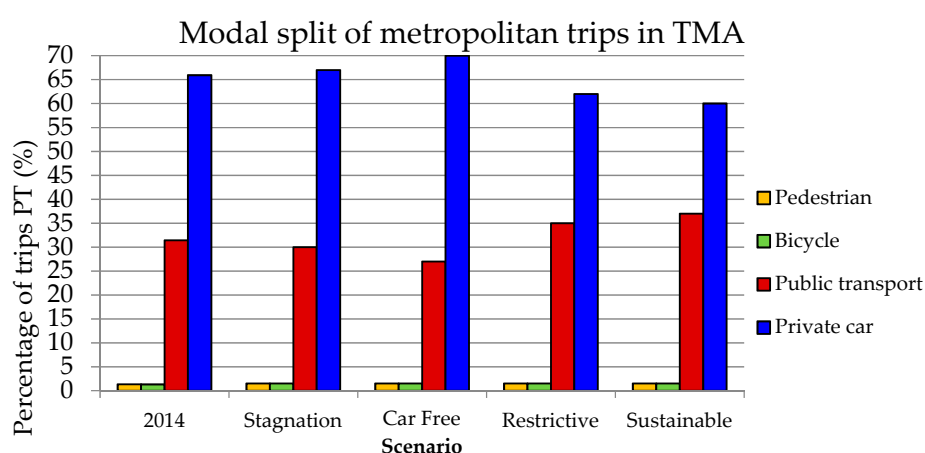


Figure 13. Existing (2014) and forecasted modal split of metropolitan trips across the TMA in 2030 for the particular STM development scenarios. Source: [34].

4.3.4. Mobility

Surveys of TMA residents' transport behaviour show that more than 90% of the MA's population make at least one trip a day but mostly two trips. The reason for two trips is that an overwhelming part of the population travel each day for work, school, university and so forth and then return home. Some of the people make additional trips on their way back to do shopping or use services which generates additional trips and increases the mobility rate.

The TMA's average mobility rate is 2.36 [STM]. Those living in the core have a rate of 2.42 while elsewhere in the area it is 2.30. The people of the Tri-City make more trips daily because passenger transport services are good and the services are nearby which means that they do not have to limit their trips. Another reason for the different rates may be unemployment which is lower in the metropolitan core and the share of post working age people which is higher outside the core.

The people of the TMA usually travel within the boundaries of their municipalities. Such trips are made by 78% of Tri-City residents and 60% of other TMA residents [34]. The Tri-City rate is higher because Gdańsk and Gdynia provide a huge labour market and education opportunities. This attracts residents from other municipalities who travel there to work and study. Tri-City residents do not have to travel outside their city because their jobs, schools and services are within the area. County boundaries are crossed more often by TMA residents who do not live in the Tri-City. The results of the analysis are the answer to the research question four (RQ4) and five (RQ5).

5. Comparative Analysis of NUA and STM

5.1. Comparative Analysis of Consistency between STM and NUA

In line with EU guidelines, all of Poland's transport strategy papers are based on principles of non-discrimination and common access to mobility, transport services and infrastructure. In this respect the TMA strategy is strongly aligned with the NUA declaration. While the strategy makes no direct reference to the NUA, its vision, goals and planned steps and interventions are geared towards the idea of sustainable transport, clear evidence of the linkages between the STM and NUA (Table 2).

Table 2. Comparing consistency between STM goals and programmes and NUA recommendations.

| Pillars of Sustainable Development | Sustainable Transport Challenges | Goals | | Programmes/Recommendations | |
|------------------------------------|--|----------------------|--------------------|----------------------------|---|
| | | STM (see chapter 5) | NUA (see ref. [2]) | STM (see Figure 7) | NUA (see ref. [2]) |
| Environmental | Reduce the adverse impact of climate change and adapt to climate change, minimise the effects on the environment and transition to sustainable consumption and production patterns. | B.3. | 13a, 13g, 13h | P3, P4, P5, P6 | 54, 115 |
| Social | The right to an adequate standard of living, without discrimination, equal access to high quality transport services, good infrastructure ensuring mobility for all, improving road safety. | B.1. B.2. B.3. | 13a, 13f | P3, P4, P5, P6 | 36, 54, 66, 113, 114, 115 |
| Economic | Stimulate sustainable economic growth, strengthen the spatial relations of functional areas, proposing legal mechanisms and funding for work for an efficient and economically viable transport. | A.1. A.2. | 13 e | P1, P2, P3 | 15 ci, 32, 36, 50, 54, 66, 116, 117, 118, 141 |

A comparison of the NUA and STM shows a number of similarities such as vision, policies, objectives and actions although they were developed at different levels (Table 2, Table 3). The authors point out the differences, a result of dissimilar spatial, transport or traffic conditions which both documents address. The results of the analysis are the answer to the research question six (RQ6).

5.2. Comparative Analysis of Area of Interventions in STM and NUA

The authors conducted a comparative analysis of the NUA and STM for references the documents make to areas of interventions which are key to how transport systems operate and grow (Table 3).

Table 3. Comparison between STM and NUA in terms of areas of intervention related to transport system operation and development.

| Area of Intervention | STM (see ref. [14]) | NUA (see ref. [2]) |
|--|---------------------|--------------------|
| Reach of functional links | | |
| within the city | *** | *** |
| urban-rural | * | ** |
| suburban | *** | - |
| regional, national, international | *** | - |
| transit | *** | - |
| Transport system functions | | |
| access—to sea ports and their industrial and service sites | *** | - |
| transport—supra-regional and international transport hubs | *** | - |
| transport—integration of transport subsystems | *** | * |
| integration—urban and rural areas | * | ** |
| integration—residential areas with the rest of the urban tissue and the surrounding functional areas | - | * |
| social—preventing social exclusion | - | *** |
| environmental—promoting clean energy | ** | * |
| environmental—reducing and mitigating climate changes | - | * |
| environmental—sustainable patterns of consumption | *** | ** |
| tourism—accessibility of tourism areas | ** | - |
| economic—stimulating sustainable economic productivity across the entire urban-rural continuum | * | * |

Table 3. Cont.

| Area of Intervention | STM (see ref. [14]) | NUA (see ref. [1]) |
|---|------------------------|-----------------------|
| Transport infrastructure | | |
| green | - | * |
| open, efficient, innovative, safe (road traffic) | ** | ** |
| accessible (sea and land ports) | *** | * |
| adjusted to age and gender | - | ** |
| walking and cycling | *** | * |
| rail, air, road | *** | - |
| integration transport hubs | *** | - |
| Mobility management | | |
| monitoring people's transport behaviour and preferences | *** | - |
| education, promotion of active forms of mobility | *** | - |
| shaping transport behaviour | *** | * |
| organisational, spatial and investment efforts to enable optimal transport choices | *** | * |
| Transport offer | | |
| common (for all) | * | * |
| no constraints for people with disabilities | ** | * |
| affordable | - | * |
| optional for those non-motorised | *** | * |
| using the most recent technologies to deliver joint mobility services | *** | * |
| Conditions of growth | | |
| spatial, social, legal, planning | ** | *** |
| traffic, demographics, organisational | *** | - |
| Urban logistics | | |
| support for economic growth | * | * |
| not affecting negatively living conditions in the city | * | * |
| logistics centres | ** | - |
| Managing growth | | |
| transparent, hierarchical management structures | * | *** |
| public participation | * | ** |
| implementation of policies and strategies | * | ** |
| implementation of programmes | *** | * |
| cooperation between all levels of administration | * | ** |
| consistency of sectoral policy goals across levels | *** | ** |
| sectoral policy taking account of functional areas according to national law | *** | * |
| strengthens the capacity of regional and local authorities to implement metropolitan multi-level governance | *** | * |
| going beyond the administrative boundaries and based on functional criteria, | | |
| mechanisms of metropolitan funding, | - | ** |
| strengthening the role of small and medium-sized cities and towns | - | ** |
| mechanisms of inter-municipality cooperation to deliver metropolitan public services, | ** | ** |
| Spatial planning | | |
| urban planning: moving functions, preventing sub-urbanisation, denser development, compact structures | ** | *** |
| regional planning: polycentricism, concentration, multiple functions | ** | ** |
| mitigate mobility challenges and needs | *** | ** |
| reducing costs of service delivery per capita, | - | * |
| integration of spatial planning with transport planning | * | *** |

The results of the analysis are the answer to the research question seven (RQ7). -: no reference; *: incidental reference in the text; **: several references in the text; ***: several references in the text with a description. Legend:

Areas of intervention with document consistency; NUA areas of intervention requiring recommendations; STM areas of intervention requiring recommendations.

5.3. Discussion of the Results of Analysis

The chronology of the documents explains why the strategy makes no direct reference to the NUA. But because its vision, goals and planned steps and interventions are geared towards the idea of sustainable transport there is clear evidence of the linkages between the STM and NUA. The documents also differ substantially on the subject and object. While the NUA refers to cities in general and urban development in all spheres, the STM refers to a specific metropolis and the development of its transport system. As a consequence, the NUA addresses primarily links within urban areas and urban-rural links. The STM, however, looks at the reach of functional links up to the international level, a result of the metropolitan functions.

When analysed in the context of the NUA, the TMA's transport system displays some features which are not sufficiently covered in the NUA. Because it is an extensive area it will typically have some characteristics that are strategic and critical for ensuring a balanced development across the metropolitan area. These include: the role of external and internal transport links in shaping the metropolis' transport system, modal split and trip length, transport safety, local authority cooperation and transport preferences of the metropolis population.

The STM is a sectoral strategic paper that can use the NUA as a set of guidelines. Although largely similar, the visions defined in both documents are to be accomplished using different tools. The NUA contains a set of principles designed to achieve the goals including integrated approach to urban and territorial development by implementing policies, strategies and actions across all levels and promoting cooperation across all levels of administration. The STM's vision is to be achieved by setting strategic goals and programmes of cooperation which contain groups of selected external and internal intervention areas (see Section 4.2). As regards effective implementation, the NUA includes commitments to create legal and financial frameworks at all levels of governance and to build conditions for cooperation and public participation. The STM, on the other hand, is a document adopted by municipalities that cooperate within the TMA. It sets a framework for mutual efforts to solve transport problems which spill over the administrative boundaries.

There are differences between the documents. The NUA covers directly the need to integrate transport and spatial planning. The STM is a sectoral document which corresponds to other planning and programming papers such as the Pomorskie Regional Spatial Development Plan, the Tri-City Metropolitan Spatial Development Plan and the Gdańsk-Gdynia-Sopot Metropolitan Strategy until 2030. Because they are consistent, the documents carry a single and clear message on how the Metropolitan Transport System should develop, the transport needs and realistic ways of meeting those needs.

Because the NUA does not address the fact that metropolitan areas differ from urban areas, it can only be partly applied to metropolitan transport policy-making. The marginal treatment of the common development trends of the world's metropolises in general is also noted by [46] by stating that the Habitat III New Urban Agenda neither exhausts the debate on metropolitan issues nor provides sufficient guidance to address key sustainable urbanization issues at metropolitan scale in rapid urbanisation contexts.

Presented in the NUA, the principles, actions and delivery mechanisms of transport systems have some overlap with the STM. The differences are primarily caused by dissimilarities between urban and metropolitan conditions in areas such as spatial development, legal conditions of governance, funding infrastructure that crosses administrative boundaries and different transport characteristics (number and length of trips, modal split). A full implementation of the NUA, however, is hindered by failure to meet the NUA's declarations, regarding coordination between stakeholders and a lack of funding to support a territorially balanced transport system.

6. Conclusions and Recommendations

Conclusions. The studies have demonstrated the NUA's utility for setting visions, main principles, implementation and review at the metropolitan level. In the case of transport, however, there is no correspondence or interventions which could be used to develop a metropolitan transport system. There are three issues which cause potential limitations in applying NUA guidelines directly to metropolitan transport system documents:

- failure to deliver what the NUA calls for, i.e. ensuring that the legal and financial frameworks are right for the functional and spatial structures of metropolitan areas,
- characteristic conditions of how a transport system develops in metropolitan functional and spatial structures (such as length of trips, possibilities to develop infrastructure and public transport services, cooperation of entities, etc.),
- inconsistency and inadequacy of the political declaration which the NUA is with its ideas and programmes and the goals set out in strategy papers such as the STM which draw on diagnoses, data analyses and predictive modelling.

As regards the first issue, the NUA recommends to add the metropolitan level to the land use system.

The other two issues are a result of the differences between urban transport systems and how they operate and develop and mobility management at the metropolitan level. This is why by concentrating on cities the NUA leaves out some of the characteristics of metropolitan areas. As a consequence,

although the NUA can work successfully for metropolitan cores, outer areas are not covered directly. The article demonstrated that by comparing the NUA with the STM.

The differences between the STM and NUA in how they tackle selected areas of intervention involving the operation and development of transport systems suggest that when these documents are updated or delivered it would be worthwhile to complement the principles and actions with new ones that reflect modern day development problems of urban and metropolitan areas. Based on the research and analysis carried out, recommendations for NUA and STM were developed, which provide answers to the practical question one (PQ1) and two (PQ2).

Recommendations for NUA. When implementing the NUA in developing metropolitan areas, it is recommended to adapt the NUA principles to the specific conditions that prevail in the functional areas. The spatial structure and the distribution of destinations and sources of traffic means that:

- trips are relatively long, sometimes impossible to be made walking or cycling,
- means of transport must be integrated to reflect different distances and a rail and bus passenger system must be built (a shuttle service),
- the quality of rail and road infrastructure to be used by buses and transit traffic to TENT hubs must be improved (sea ports, airports); this problem applies not only to emerging metropolises which still carry a legacy of poor quality transport infrastructure.

In the context of the above problems and phenomena it is noted and recommended that successive urban agendas should address problems specific to metropolitan areas such as:

- presence of transport hubs and logistic centres,
- presence of infrastructure to access transport hubs and logistics centres used by motor, rail and inland water transport,
- tourist traffic services,
- a strong need to integrate transport sub-systems,
- institutionally and legally complex mobility management.

Recommendation for STM. It is recommended that the STM should in particular consider the following areas of intervention proposed in NUA, that are part of transport management:

- prevent social exclusion,
- prevent and adapt to climate change,
- adapt the infrastructure to the age and gender of transport users,
- shape affordable transport tariffs,
- identify funding priorities for transport sub-systems,
- reduce transport costs per capita.

The above groups of intervention should complement the objectives of the STM and form part of the efforts carried out by metropolitan entities.

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