



## The tendency of city stakeholders to implement sustainable logistics measures using the port city of Gdynia as an example

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**Keywords:** city logistics, TENTacle, urban mobility, mobility habits, urban freight movement, sustainable urban transport, SULP

**JEL Classification:** R410, R41, R42

### Abstract

A holistic approach and stakeholder consultation are necessary before implementing a particular city logistics measure. The need to implement sustainable urban logistics solutions is particularly important in seaports located in cities. Such cities, particularly Gdynia, have a high intensity of cargo flows resulting from transport connected with their port facilities. The purpose of this article was to identify the level of acceptance of sustainable and innovative urban logistics solutions by entities that use the services of the seaport in Gdynia. We investigated whether the proposed solutions found sufficient acceptance among the respondents, and which of the proposed solutions were the most preferred by stakeholders. We hypothesized that urban logistics solutions were not sufficiently accepted by the stakeholders of the seaport of Gdynia. In order to analyze the awareness of the involved parties, we surveyed parties at the Port of Gdynia as part of the Interreg project called TENTacle. Our findings did not support this hypothesis with respect to such measures as FQP, the use of interactive city maps, night deliveries, and the use of ITS, as these are the solutions most preferred by the stakeholders of Gdynia. The results of this study can therefore serve as an important tool for the city of Gdynia, and similar cities, when preparing sustainable urban logistics plans.

### Introduction

The implementation of sustainable urban logistics plans is particularly important in port cities due to their high level of transport activities. It is estimated that more than 80% of the global volume is transported onboard ships and operated by seaports (UNCTAD, 2020). A seaport is a transport hub that supports several types of transport. In most European ports, inland transport is mainly operated by road, which contributes to the movement of large trucks in port cities. International trade is growing, and the level of transshipments in ports is increasing.

Consequently, the amount of road transport in cities is increasing. As a natural result, we have observed a significant rise in congestion and pollution associated with transport. The level of congestion is often identified as the additional travel time compared with the free-flow situation, expressed as a percentage. Among the largest seaports in Europe, the highest level of congestion is in Hamburg. In 2019, the level of congestion in this city was 34%, which was 2% higher than in 2017. In Antwerp and Rotterdam in 2019, congestion was recorded at 32% and 25%, respectively, which were 1% and 3% higher than in 2017 (TomTom, 2019).

Due to city-forming functions, ports are often located in the middle of a conurbation or near city centers or settlements. Consequently, port cities become agglomerations that perform traditional urban functions, which is why port authorities and municipalities need to cooperate in urban logistics and spatial planning to reduce the external costs of road transport (Kotowska & Kubowicz, 2019).

According to Carpenter and Lozano, port cities should cooperate with stakeholders to ensure that their infrastructure is efficient and to make sure that the stakeholders stay informed about new sustainable measures (Carpenter & Lozano, 2020). Wan et al. argued that local road capacity is the top constraint that impedes port development and growth according to seaport managers (Wan, Zhang & Yuen, 2013).

The problem also applies to port cities in Poland, including the city of Gdynia, which is a city hub and an urban node recognized by the TEN-T network. It is a city hub for the flow of goods and is located next to the Downtown. The port of Gdynia is located on the axis of the transport TEN-T network in the Baltic-Adriatic corridor. In 2015, the average daily annual traffic of motor vehicles on the national road network in Poland was about 11.2 thousand vehicles per day (Opoczyński, 2016). Meanwhile, in the port region of Gdynia, this traffic was almost six times higher and was estimated to be 65.6 thousand vehicles per day (GDDKiA, 2016). In 2017, the average level of congestion for the Tricity agglomeration (cities of Gdańsk/Gdynia/Sopot) was recorded at 29%. In 2019, the level of congestion increased to 33%, which is higher than in the port cities of Rotterdam and Antwerp (TomTom, 2019).

In 2017, Gdynia introduced the Strategy of City Development by 2030, which identified the city's potential and challenges. An important element of the city's development strategy is shaping sustainable freight transport in its future sustainable urban logistics plan (SULP). The analysis and selection of measures that should be implemented in this process should consider their levels of acceptability by various entities; therefore, the purpose of this article is to identify the degree of acceptance for sustainable and innovative logistics activities by entities that use the services of the seaport in Gdynia. Research questions were formulated as whether the proposed solutions find sufficient acceptance among the respondents, and which of the proposed solutions are most preferred by the stakeholders of the port of Gdynia. As a hypothesis, it was assumed that urban logistics solutions were not sufficiently

accepted by the stakeholders of the seaport of Gdynia.

## Literature review

In recent years in Europe, numerous projects have been undertaken to improve the function of cities and support urban logistics (Perboli, et al., 2014; Aditjandra & Zunder, 2018). The first goal is to improve the infrastructure efficiency or implement software that improves the communication of commodity flow organizers. Urban logistics projects are most often aimed at reducing individual motorization, lowering pollutant emissions in urban spaces, consolidating goods in urban consolidation centers, and changing regulations, i.e. altering restrictions on navigating in the urban area concerning the size and type of vehicles, hours of entry, charges, exhaust emissions, and stopping; however, introducing new solutions is impossible without a long-term perspective on the part of transport policymakers.

By now, nine European cities have already introduced their SULPs (Lucca, Trondheim, 's-Hertogenbosch, Burgos, Almada, Dundee, Alba Iulia, Serres, and Balchik), and seven are in the process of introducing it (Budapest, Bologna, Poznań, Rijeka, Stuttgart, Brescia, and Maribor). To fully understand the possibilities of mitigating urban freight flows and solve the problem holistically, there is a need to tackle urban freight on the level of the entire supply chain (including enterprises' strategies) and from the perspective of a given urban area. Most cities do not hold data on how many trucks are operating within the cities, on the origins, destinations, routes of trucks, nor on the number of business deliveries made (Giliano, 2018). This lack of data requires significant commitment and awareness of individual entities in the field of shared responsibility for city development. Identification and analysis of other possible measures to be adopted by the area should be the result of a partnership with all the city stakeholders. The tendency towards adopting new sustainable logistics measures can be measured through a survey conducted among the stakeholders.

Taniguchi (Taniguchi, 2014) pointed out that city logistics can contribute to the creation of more efficient and environmentally-friendly urban freight transport systems when innovative information and communication technologies (ICT) and intelligent transport systems (ITS) are used. These must be accompanied by a change in the mentality of logistics managers and public-private partnerships. As Aditjandra and Zunder (Aditjandra & Zunder,

2017) noted, when developing a multi-dimensional, multi-parametric typology for city logistics, ‘one of the major problems in selecting urban freight transport (urban freight) solutions for future implementation is choosing – from many available options – those that meet the needs of a given city (via key urban freight stakeholder demand) that are compatible with the agreed stakeholder goals’. Compromise is a critical success factor, according to Russo and Comi (Russo & Comi, 2010) and Lindholm (Lindholm, 2014). A compromise can be achieved with FQP, which should be perceived as a key factor for studying and implementing successful city logistics initiatives. Their acceptance may be the crucial element in the success of a city’s transport policy.

According to Kaur and Garg (Kaur & Garg, 2019), the lack of standardized and precise indicators defining the sustainable development of urban areas makes it difficult to uniformly assess sustainable urban development under various conditions. The authors recommend drawing up a coherent list of indicators and range of weights that change depending on the context, which will allow for more precise monitoring of the progress of cities towards sustainable development and a measurable relation of some urban centers to others. Buzási and Jäger (Buzási & Jäger, 2020) argued that while the degree of sustainability is often studied at the level of cities, it is rare to distinguish within an individual city’s areas, each of which has its own characteristics.

According to Palermo et al. (Palermo et al., 2020), among the factors influencing the situation in a given area, the population size has the strongest influence on planned and implemented projects. Soma et al. (Soma, Dijkshoorn-Dekker & Polman, 2018) indicated that stakeholders make an increasing contribution by presenting different types of knowledge and different visions of urban areas in the future. Stakeholder participation effectively contributes to increasing sustainable urban development. The responsibility of the authorities is to lead, allocate, take responsibility for decisions and actions, and demonstrate whether and how these responsibilities have been fulfilled. Designated representatives can display more collective, holistic, and long-term thinking by achieving a shared understanding.

According to de Carvalho et al. (de Carvalho et al., 2020), in many places, there is still the need for educational programs provided by governmental or non-governmental organizations, so that urban pollution is minimized and delivery truck utilization

rates are optimized. De Oliveira et al. (de Oliveira et al., 2019) indicated that there are still barriers related to the lack of a UFT planning process.

One can see a gap in the current research, as there is still not a sufficient reference to the level of acceptance of sustainable and innovative solutions in the field of urban logistics by city stakeholders. This article attempts to partially fill this gap. The knowledge obtained based on the conducted research on the level of acceptability of possible solutions in this respect may serve as the basis for defining guidelines regarding the creation of new transport policies in port cities, which should be compatible with sustainable urban logistics.

## Methods

Stakeholders in the city include residents, shippers, administrators, and freight carriers (Tamagawa, Taniguchi & Yamada, 2010); however, Anand et al. (Anand et al., 2012) divided stakeholders into two groups only – public and private ones – noting that their interests (during the common purpose – transporting goods) are contradictory. A similar breakdown was used by K.W. Ogden in the Urban Goods Movement handbook (Ogden, 1992).

The study was based on the SULPiTER project guidelines, in which measures from the categories of infrastructure, technology, and regulation were selected (Rubini & Lucia, 2018). Questions for the tenants of the area/recipients of the supply process are divided into groups:

- **Infrastructure and its use** (multifunctional lanes allowing for the privileged movement of public transport vehicles and freight vehicles, loading/unloading bays, using bus stops as loading and unloading zones, and urban consolidation centers (UCC) as a new infrastructural solution);
- **EU’s most popular sustainable urban logistics solutions** (UCC as a conceptual solution, testing state-of-the-art logistics solutions, e.g., drones and autonomous vehicles, benchmarking, low-emission zones (LEZs) and zero-emission zones (ZEZs), monitoring systems, the inevitability and severity of fines);
- **Cooperation between operators in the transport sector** (suppliers’ cooperation in improving efficiency);
- **Use of ICT tools** (intelligent traffic control system, an electronic platform that combines supply and demand sites, and interactive city maps).

To identify the level of acceptance of the proposed solutions among stakeholders of the seaport area in

Gdynia, a survey was conducted that involved interviewing three groups of respondents:

- Entrepreneurs operating in the port area (tenants of the district premises) – 93 interviews in 78 companies (from the total company population of 205 companies);
- Suppliers to the area – 43 drivers;
- Employees from the companies located in the area – 150 interviews in 56 enterprises.

We surveyed the entrepreneurs operating in the port area. The respondents were asked about their acceptance level with reference to chosen city logistics measures, asking for positive (accepting) or negative (not accepting) opinions. The elimination of a neutral response and graduated weights in an even number forced the respondents to make a clear decision.

In addition to the part conducted based on the SULPiTER project guidelines, entrepreneurs were also asked about their attitude toward environmental protection.

The analysis of the data obtained from the survey conducted among the tenants of the port area of Gdynia was conducted using response structure indicators and response balances and weighted averages of the responses.

To determine the strength of acceptance or non-acceptance of the specific proposals included in the survey,  $q$  response structure indicators and response balances were used for the statistical analysis of survey results. Due to the abovementioned omission of the possibility of giving neutral responses, the balance of responses ( $S$ ) was expressed on a two-point scale according to formula 1:

$$S = 100 \frac{n_p w_i + n_n w_j}{N} \quad (1)$$

where:

- $n_p$  – number of positive answers,
- $w_i$  – value 1 if the answer is positive,
- $n_n$  – number of negative responses,
- $w_j$  – -1 if the answer is negative,
- $N$  – total number of responses.

Response balances are normalized values that take a value from -100 to 100. The balance sign is a direct indication of the predominance of respondents accepting (positive) or rejecting (negative) a certain solution in the field of sustainable urban logistics.

The absolute values of response balances were used to determine the strength of acceptance or non-acceptance of the proposed solutions (the higher the value of the indicator, the greater the intensity of

a given opinion). Because a detailed interpretation of the number of response balances is 'soft', it has been arbitrarily accepted that opinions supporting or not accepting specific solutions are:

- Poor when the absolute value of the balance is below 20;
- Moderate when the absolute value of the balance is between 20 and 40;
- Clear when the absolute value of the balance exceeds 40.

The ratio of the port area lessees to the proposed solutions can also be presented using the weighted response rate. This indicator results from the following formula:

$$\text{Score} = \frac{\sum_{i=1}^m w_i x n_i}{N} \quad (2)$$

where:

- $w_i$  – weight for the  $m$  answer variant,
- $n_i$  – the number of responses to a given answer variant,
- $N$  – the total number of responses to a given question.

Assuming analogous weights as in the case of the measure presenting the balance of responses, this index ranges from -1 to 1, with values below zero indicating the intensity of negative ratings, and values above zero indicating positive ratings.

Moreover, several dozen **drivers** servicing the area were asked about the problems that directly affect them. This was performed using a computer-assisted direct interview (CAPI).

The final part of the study was devoted to the **mobility habits of employees** of enterprises located in the port area using computer-assisted web interviews (CAWI) and computer-assisted telephone interviews (CATI).

## Results – response from tenants from the surveyed area

### Questions on infrastructure and its use

Infrastructure in cities is sometimes limited, and there is not always an opportunity to develop it. Conceptual solutions such as multifunctional lanes allowing for the privileged movement of public transport vehicles are often used to increase accessibility, but these solutions also include vehicles for transporting passengers, such as taxis or carsharing vehicles. Creating such lanes within existing infrastructure has been assessed by the majority of the respondents (65.6%) as important or very important.

Those who assessed this solution as irrelevant justified their choice by lack of belief in its effectiveness.

Another infrastructure solution for facilitating the distribution of goods in the city is designing exclusive loading/unloading bays. Although they were mostly perceived positively (69.9% of all the respondents approved the idea), not all companies considered them relevant. According to traders, the unloading/loading process very often takes place on the premises of the receiver, which determines the specificity of the port areas, so such coves are not needed in the area. Respondents who recognized the solution as important noted that this solution is indispensable in city centers. The dedicated loading/unloading bays enforced by the prohibition of stopping for vehicles other than delivery trucks and vans, make it possible for the suppliers to spend less time in the area. In addition, the rotation of the occupied bays, achieved by time restrictions, resulted in a lower density of delivery vehicles at the same time. The bays are considered as a non-essential solution by third-party recipients, thus demonstrating a lack of empathy for suppliers' problems and their role in the supply process.

In many cities with historical buildings, last-mile logistics are conducted using an urban consolidation center (UCC). This solution aims to improve energy efficiency, increase throughput, and reduce congestion and pollution emission. The main task of this type of object is to minimize nuisances resulting from deliveries in cities by minimizing their number through consolidation (Fijałkowski, 2010).

For the respondents that participated in the survey, opinions on the merits of such an urban hub were divided. Although 60% of the respondents considered this to be significant, 40% considered the solution to be invalid. The respondents, who were from the group that undervalued UCC advantages, assessed it as 'impractical', 'unnecessary', 'costly', or simply had no knowledge of the solution.

Previous simulations verified the legitimacy of the UCC for supply service in Gdynia and Gdańsk centers and indicated the economic and environmental benefits of such a facility, but the concept seems complex and costly (Kaszubowski, 2012; Matusiewicz, 2017).

To effectively manage the infrastructure, it is possible to extend the functionality of the existing one – e.g., by using bus stops as loading and unloading zones. Most respondents (70%) asked about the legitimacy of such an idea claimed that the idea was not reasonable, and the respondents pointed out that the stops should only serve this function for public

transport passengers. Among the people who liked the idea, suppliers constituted the majority. They often look for a place to stop and unload deliveries, sometimes stopping at bus stops and breaking traffic regulations.

#### **Questions on EU most popular sustainable logistics measures**

Transport accounts for almost a quarter of Europe's greenhouse gas emissions and is the main cause of air pollution in cities (Aditjandra & Zunder, 2018). The aforementioned UCC is a solution that reduces the emissions of harmful substances because, due to its operation, fewer vehicles are directed to the city center. Moreover, the UCC is often operated by unconventionally driven vehicles (electric, CNG, hybrid, cargo bikes, and electric scooters).

In this part of the questionnaire, the question about the legitimacy of the creation of urban hubs was asked again, encouraging respondents to evaluate this solution from a different point of view. This time, the answers were spread equally on the side of opponents and supporters. Among the opponents' arguments, large supply dimensions and a high level of complexity of the process were mentioned. Some respondents did not know the UCCs, which led to negative responses. The supporters' arguments included environmental impact. Nobody pointed to the economic legitimacy of such a solution, although there are models proving the cost rationality of the UCC.

The respondents were asked to assess the significance of testing state-of-the-art logistics solutions, e.g., drones and autonomous vehicles, which are tested in the supply process in Europe and globally. Positive and negative reviews were split in half. Respondents did not like novelties and justified their approach by the lack of adequacy of these solutions in the port area, general skepticism, or lack of knowledge. Proponents of new technologies pointed to the inevitable implementation of innovation in logistics processes.

Effective planning of development involves the efficient use of available resources and also their planning so that a company's results can improve in the future. Benchmarking, based on the comparison of a company's processes and practices with market-leading companies of a similar business profile, aims to improve practices or eliminate errors using others' mistakes; however, this requires sharing knowledge, data, and information. In this study, the respondents were asked about their general

willingness to undergo benchmarking. 70% of the respondents claimed that they would rather not or would definitely not undertake such a process, with the most open attitude to such solutions being among medium-sized enterprises. In the explanatory memorandum, no need or unwillingness to share secret data was given. The arguments of the respondents open to benchmarking were interesting. Among the supporters, the justifications concerned learning from each other, using information as lessons, obtaining financial benefits, satisfying curiosity, and increasing efficiency.

In many cities in the European Union, sustainable solutions have been implemented to improve the efficiency of the distribution of goods in cities. The most common examples are time restrictions on entry to the center (including night deliveries), tonnage restriction for vehicles entering the center, environmental constraints – low-emission zones (LEZs) and zero-emission zones (ZEZs), which vehicles may only enter when complying with certain standards, and entry for others is impossible or limited by high fees.

Respondents were asked about these solutions in the survey. Regarding night deliveries, almost 80% of the companies surveyed considered this to be justified. The main argument was the effectiveness of such deliveries and more efficient access to the customer. Such a solution would be particularly appreciated by the companies operating in the port area (> 78%). Among the arguments of those accepting the solution, reduced congestion during the day was also mentioned.

With regard to the LEZ and ZEZ – more than a half (54%) found the solution not justified or unfounded, but at the same time, a significant proportion (46%) of the respondents would accept its implementation. The following arguments against the restriction were named: freedom of choice, low availability of space, and high costs of environmentally-friendly vehicles. Among the favorable opinions, the concern for the environment and less heavy congestion in the center were named.

In the study, the respondents were asked about their attitude towards the enforcement of a penalty for potential traffic regulation abuse. One example of such an action proposed in the study was a monitoring system for drivers of delivery vehicles. The system was supposed to support correct behavior in an area. Almost 70% of the respondents assessed the need to introduce monitoring processes as important and very important; however, the opponents perceived the monitoring system not as a tool to increase

the efficiency of implementing the regulations, but as a tool for obtaining money in the form of penalties. Some respondents stated that this would cause additional stress to the drivers. Proponents saw this as a way to increase safety and prevent dangerous situations, and also to increase the employees' ability to supervise the drivers' work and learn how to improve the process.

Lawyers and psychologists have argued for many decades on whether the optimal way to reduce the incidence of violations is the severity of punishment or its inevitability. For this study, it was assumed that it was not severity, but rather the inevitability of the punishment, that discouraged drivers from breaking the rules – a potential driver wishing to break the rules would be more discouraged to do so by the certainty of getting caught, regardless of the severity of the penalty, rather than by receiving a high fine, without the certainty of getting caught. The system is, therefore, more effective when the restrictions are enforced.

The respondents were asked about the inevitability of fines for a stopover in forbidden places and for entry into enclosed areas. 55% of the respondents considered that the imminence of the penalty for a stopover in an unauthorized location was a significant or very significant factor, with the fewest proponents of the enforcement being among suppliers with their own fleet. The opponents (45%) alleged that "imposing penalties is abusive". The proponents stated that the penalties counteract violations, improve safety, and enhance traffic.

#### **Questions on cooperation between logistics service providers**

Collaboration gives companies a number of benefits and allows them to strengthen their competitive advantage. An important factor in modifying business processes is increasing the awareness of the benefits of cooperation with other actors. This collaboration can take different forms.

As the company interviews showed, the respondents showed a tendency (56%) to cooperate with other suppliers to improve the efficiency of their business to save time or reduce costs. While cooperation in the cluster is based on multi-level management, the Physical Internet is directly connected to fleet management and the elimination of empty journeys. Again, protection of company information and the limited confidence that a competitor would become a co-operator were some of the concerns.

The subsequent questions, therefore, concerned the assessment of the benefits and risks. With regard to the benefits, 16.1% of respondents drew attention to cost and time savings (37.6% to cost savings, 5.4% to time savings), 8.6% noted organizational improvements, and 9.7% did not see the benefits. Interestingly, 100% of large companies pointed to cost savings. In assessing the risk of a possible joint organization of logistic processes, 32.3% of the respondents pointed to the concern about unfair co-operators and stealing customers, 17.2% mentioned problems connected with organizational difficulties, 10.8% doubted the high quality of a co-operator's work, 5.4% were afraid of conflicts, and 16.1% did not see any problems.

When asked about the conditions (technical, organizational, legal) necessary to fulfil a possible joint organization of logistic processes, 24.7% indicated the need to sign a contract that would determine the penalties for not following the contract. 10.8% of respondents expected institutional support for the cooperation process, such as financial support.

Regarding the question about the need for cooperation between companies operating in the area (traffic and infrastructure managers, authorities, port managers, and suppliers) in terms of development and efficient functioning of the port district in Gdynia, 86% of surveyed companies replied that such cooperation is necessary. The basic argument given against cooperation relates to concerns about too much interference in a company's operations. Other indications included insufficient knowledge to determine their opinion or conclusion that cooperation would not be possible in general.

The desired scope of this cooperation would depend on the following (the sum does not equal 100 because the respondents had the opportunity to select more than one answer):

- Meetings to exchange opinions, suggestions, or experiences (freight quality partnership, FQP) – 71.3%;
- Web portal – 65%;
- Constant exchange of information – 100%.

The proposed forms, therefore, entail a desire to improve the flow of information between stakeholders.

#### Questions on the use of ICT tools

The previous analysis revealed that, while companies do not show a significant interest in initiating cooperation with other industry stakeholders or in joining activities that would involve the need to

provide company information, they are open to the use of system solutions that can improve the functioning of their business.

The respondents were asked about their willingness to use ICT solutions that provide, for example, the opportunity to manage the usage of unloading bays through a sensory network integrated with smartphone applications. 57% of the respondents showed interest in such solutions, while others stated that they would not benefit from them because they prefer traditional solutions, and they do not believe in the effectiveness of innovative inventions. They also said that they would rather have more parking spaces than a tool to manage existing ones. ICT proponents were convinced that this would facilitate the distribution process.

The concept of extending the scope of activity of intelligent traffic control systems for urban freight traffic (e.g., information boards with real-time information about the location and availability of parking spaces) was also addressed. The rationality of enhancing functionalities with information useful for freight traffic was positively assessed by more than three-quarters of the respondents, especially suppliers. They recognized the advantages of improving road traffic or general facilitation of drivers' work (e.g., by informing them about vacant parking spaces). A skeptical minority of the respondents considered the solution to be unhelpful and unconvincing.

In this section, respondents were asked about their willingness to cooperate. This time, the solution presented was an electronic platform used by both the suppliers and recipients of the area, allowing for information exchange about available loading spaces for delivery vehicles. 48.4% of the companies expressed their willingness to use it, arguing that in such a case, the organization would be improved and costs would be reduced. The opponents claimed that this would not make sense, and it would violate the interests of carriers by revealing company information. The recipients outside of the port and suppliers with fleets were more favorable towards the solution.

In the survey, respondents were asked about their willingness to use a platform connecting demand and supply sites. Half of the companies expressed their readiness to use such a tool. The basic negative motivation was ignoring the need itself or a belief that such a solution does not apply to their company profile in general.

The next solution does not require involvement from any of the groups surveyed and can facilitate movement around the city, so it was met with a warm welcome from the respondents. When asked

about an interactive map of the city with current information about city traffic and available parking spaces, the vast majority (86%) of the companies assessed the implementation of such a solution as well-founded. Opponents argued that drivers would be too closely guided by the data from such a tool, while others explicitly declared the lack of belief that such a map would be reliable. A group of suppliers was particularly enthusiastic about the idea. Accumulated multiplication results give the result of a given measure, the largest number is the most optimal measure in all respects – costs, impact, savings, usability, the scale of application and, in this case, also the level of acceptance of stakeholders.

**Questions on the importance of environmental issues**

To protect the environment, the European Commission defined a goal in the 2011 White Paper on Transport (EC, 2011) to halve the use of ‘conventionally-fueled’ cars in urban transport by 2030, phase them out in cities by 2050, and achieve essentially CO<sub>2</sub>-free city logistics in major urban centers by 2030.

Entrepreneurs were asked to assess the significance of environmental issues. 90% of respondents

stated that environmental issues, in general, are important to them. As for the mentioned external costs, a reduction in CO<sub>2</sub> emissions was relevant for 86%. 14% of the respondents answered that they did not feel the effects of polluted air. 82.8% said that noise reduction is important to them because staying in an area with excessive noise is harmful to health. Less-enthusiastic responses towards approaching the company’s efforts to protect the environment constituted 24.7%. The respondents concerned with noise reduction were willing to make such an effort, even if it would increase the company’s costs because it would positively influence their reputation. 23.7% would take such an effort only if it did not increase costs, and 32.3% if it would mean future savings. 19.4% would not take such action because it is costly or irrelevant to them.

**Result analysis using response balances (formula 1)**

To more deeply analyze the data obtained from surveys and direct interviews among tenants of the port area, answer balances and a synthetic response rate were used (Table 1). The analysis showed that for the majority of proposals aimed at improving the flow of goods in Gdynia, there were predominantly

**Table 1. Response balances for proposed solutions to improve cargo flow in Gdynia in the port tenant stakeholder group (n = 93) (data obtained from survey results and face-to-face interviews)**

Proposed solution	Number of responses		Tidy response scale		Response balance	Score
	Accept	Not accept	Accept	Not accept		
<b>Infrastructure and its use</b>						
Multifunctional lanes	61	32	1	-1	<b>31.18</b>	<b>0.312</b>
Designing exclusive loading/unloading bays	65	28	1	-1	<b>39.78</b>	<b>0.398</b>
UCC	55	38	1	-1	<b>18.28</b>	<b>0.183</b>
Use of bus stops as loading bays	28	65	1	-1	<b>-39.78</b>	<b>-0.398</b>
<b>The most popular solutions for sustainable urban logistics</b>						
UCC	50	43	1	-1	<b>7.53</b>	<b>0.075</b>
State-of-the-art logistics solutions	46	47	1	-1	<b>-1.08</b>	<b>-0.011</b>
Benchmarking	28	65	1	-1	<b>-39.78</b>	<b>-0.398</b>
Level of acceptance of night-time deliveries	73	20	1	-1	<b>56.99</b>	<b>0.570</b>
LEZ/ZEZ	43	50	1	-1	<b>-7.53</b>	<b>-0.075</b>
Monitoring drivers’ behavior	64	29	1	-1	<b>37.63</b>	<b>0.376</b>
Imposing fines on drivers	51	42	1	-1	<b>9.68</b>	<b>0.097</b>
<b>Cooperation between economic operators in the transport sector</b>						
Cooperation to improve the acceptance of urban logistics	52	41	1	-1	<b>11.83</b>	<b>0.118</b>
FQP	80	13	1	-1	<b>72.04</b>	<b>0.720</b>
<b>Using ICT tools</b>						
Using ICT tools	53	40	1	-1	<b>13.98</b>	<b>0.140</b>
ITS	71	22	1	-1	<b>52.69</b>	<b>0.527</b>
Electronic platform combining supply and demand sties	45	48	1	-1	<b>-3.23</b>	<b>-0.032</b>
Interactive city map	80	13	1	-1	<b>72.04</b>	<b>0.720</b>



approving attitudes (positive values of response balances) rather than non-supporting attitudes (negative response balances); however, the degree of acceptance of individual solutions by tenants from the port area varied greatly. The analysis showed that:

- Strong solutions (response balances over 70) are characterized by proposed solutions such as freight quality partnerships (FQPs) and the use of interactive maps in the city center.
- Proposed solutions such as the introduction of a night-time delivery system and the use of ITS have clear support (response balances ranging from 51 to 70).
- A moderate level of acceptance (response balances that range from 26 to 50) was noted in relation to such solutions as the introduction of multi-functional lanes, the creation of bays used exclusively to service delivery vehicles, and monitoring the behavior of delivery vehicle drivers.
- Poor support (response balances in the range of 11 to 25) was noted in relation to such solutions as construction of an urban consolidation center (UCC) and creation of a UCC as a new supply organization system, assessing fines to delivery vehicle drivers that illegally park their vehicles, cooperation of suppliers with recipients to increase the efficiency of urban logistics, and the use of ICT tools.

The results showed that some of the proposed solutions aimed at improving the functioning of supplies in the city of Gdynia are not supported by the respondents. From the balance of the answers, it follows that opinions expressing a lack of acceptance, as opposed to accepting attitudes, are less diverse. There were no opinions that would indicate, in accordance with the adopted assessment scale, a strong and clear lack of acceptance. A moderate lack of support was recorded regarding the use of existing public transport stops by delivery vehicles and regarding the benchmarking concept (in both cases, a response balance of  $-39.78$  was recorded).

Solutions where negative (non-accepting) predominance was observed also included testing the latest technologies in the service of the city ( $-1.08$ ), implementing low-emission zones/ zero-emission zones (LEZ/ZEZ) ( $-7.53$ ), and the use of electronic platforms that enable information exchange between suppliers and recipients ( $-3.23$ ). The absolute values of these response balances were below 10; therefore, it can be considered that the opinion of the respondents regarding these proposals is ambiguous (the distribution of accepting and non-supporting responses was very similar).

## Results from other groups of stakeholders – service providers and employees of the companies in the surveyed area

### Logistics service providers

A separate part of the study included questions addressed to the drivers of delivery companies in the studied area. The study involved 43 drivers, and the analysis of the responses showed that:

- The vehicle structure was dominated by smaller vans, although more than 22% were trucks with a semi-trailer/container;
- Most vehicles met the highest emission standards – Euro-6 (30% share) or Euro-5 (55% share) engines;
- The main problems experienced by the suppliers were congestion, time shortage related to the number of deliveries, and difficulty finding parking places.

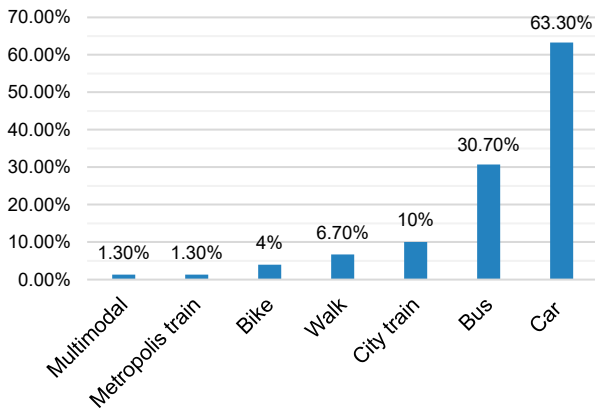
### Employees

In addition to the issue of urban freight movement, a survey about their mobility habits was conducted among employees. The study involved 150 employees of the surveyed companies. Most of the employees in the study lived in the Tricity (Gdańsk+Sopot+Gdynia), with the highest number in Gdynia ( $> 52\%$ ), followed by Gdańsk (12.7%) and Sopot (10.7%). The remaining employees commuted from counties within the metropolis. This arrangement of places of residence (or the starting points of a trip) means that employees can benefit from various transport options – city train, metropolitan train, car (own, shared), bike, bus, or walking.

The respondents mostly commuted to work using their own car (63%), of which the inhabitants of Gdynia constituted more than 61%, the inhabitants of Gdańsk and Sopot constituted 75%, whereas the inhabitants of the other counties of the metropolis accounted for more than 53%. Figure 1 shows the results of this survey question.

Bus journeys came in second place (30.7%), of which the inhabitants of Gdynia constituted 37%, the inhabitants of Gdańsk 17.9%, the inhabitants of Sopot 12.5%, and the inhabitants of the other metropolis counties 34%.

City train journeys came in third place and were chosen by 10% of the respondents (none from Gdynia, more than 14% from Gdańsk, and one-quarter of the inhabitants of Sopot).



**Figure 1. Modal split of daily trips of surveyed employees (own study, based on CATI/CAWI/CAPI with LSP company employees; n = 150)**

Only residents of Gdynia (8.2% Gdynia and 4% of all subjects) travel by bicycle, and 6.7% reach work on foot. Nobody shared a car with their colleagues.

When asked about desired changes in their commute, 52.7% replied that they would not change anything, and 22% of respondents wished to limit congestion/discharging traffic. Other less-significant answers included city train development (3.3%), other forms of public transport development (4.7%), road infrastructure expansion, and improving traffic organization (4%).

When asked about the obstacles to making changes in their daily commute, the respondents noted underdeveloped road infrastructure (6%), ‘bad attitude of city authorities’ (6%), while 43.3% would not change anything.

In many EU cities, the way to encourage workers to use public transport is to subsidize alternatives to traveling to work by car. The respondents were questioned about the idea. In more than 95% of examples, there is no such funding, and several people mentioned the reimbursement for fuel costs or subsidies for other journeys.

Although none of the respondents used ride-sharing options, 80% of respondents claimed they would share their car space with a co-worker if such a practice was subsidized by the employer.

Although in the studied area, only less than 40% of respondents travel to work by public transport, 60% of respondents evaluated urban transport solutions as good, 26% as bad, and 13% would like some improvements. Among the ideas for change, there were suggestions for more connections and a higher frequency of rides. People who rated public transport badly complained about poor connections and the infrequency of journeys.

The average time required to get to work was 53 minutes for Gdynia, 40 minutes for Gdańsk, 27 minutes for Sopot, and 36 minutes for other metropolis counties.

For people moving around the urban space, there are many mobile applications that facilitate travel planning, integration of connections, ticket purchases, etc. Half of the respondents use an app to get to work. Among the most popular is simply GPS navigation, which employees use when traveling by car. In second place, there is an application that registers the number of steps/km. The respondents also use *Jakdojade* (travel planner app), Skycash (ticket purchase app), MyBus (an application that indicates the real-time location of a bus), and SKM KomPas (application with a timetable of city and metropolitan trains).

68% of respondents assessed their traveling experience to and from work as positive, with 70% of employees traveling from Gdynia being satisfied.

According to the interview responses, 37% of respondents viewed environmental issues in everyday life as important. For others, environmental protection was not important. People for whom the environment does matter were also asked about examples of actions they take in everyday life to protect the environment. In the first place, they indicated waste segregation, followed by changing from a car to bike/public transport/walking. When asked whether they take into account environmental issues when traveling to work, 58% responded positively.

The last question for employees was to determine their willingness to participate in permanent city and port consultations and improving the availability and quality of transport services and transport infrastructure in Gdynia. 64% of respondents expressed such willingness. Uninterested respondents justified their answers with a lack of interest, lack of time, or living in a remote location.

## Conclusions

- Most of the proposed solutions for improving the flow of goods in Gdynia were accepted by the respondents, but the degree of support for these solutions was vastly different.
- Scepticism in relation to some urban logistics solutions may indicate an insufficient belief in the need to introduce improvements in the logistics services of cities, as well as the lack of sufficient knowledge about the benefits of such solutions.
- Most deliveries were operated by vehicles meeting Euro 5 and Euro 6 standards (85%), but electric or

hybrid vehicles were not used at all in deliveries to the port area.

- The basic problems declared by drivers were congestion, lack of space for unloading, and lack of time, which may indicate both poor space planning and poor delivery planning. Problems with congestion could be solved by cooperation between suppliers (e.g., load-sharing).
- The mobility habits of employees in the area are not sustainable. To get to work, most of them use their own vehicles and rarely share car space with their co-workers.
- The reasons for strong attachment to using one's own car should be viewed both in the mentality of the society, which, due to the heritage of communism, still associate their own car with high social status, as well as in the unsatisfactory public transport options within the city.
- There is a need to continue surveying the opinions of various stakeholders about the possibilities of solving urban logistics problems.
- Periodic repetition of this type of research would allow for the determination of the direction in which the preferences for various tools improve the flow of goods in cities evolve.
- Obtaining an appropriate level of acceptability of the proposed solutions is a condition for their effective implementation, which is why there is a need for their wider popularization in society.

The strength of the presented study lies in the presentation of a shared vision. Sulp should be considered as an integral part of the Sustainable Urban Mobility Plan that Gdynia adopted in 2016. Any such initiative must be a part of the overall municipal mobility strategy. To start working on the preparation of a Sulp, it is particularly important to establish partnerships with stakeholders. No effective urban transport policy is possible without prior consultation with transport companies and their organizations, local business groups, and residents. A permanent urban freight quality partnership should be created with all stakeholders, and meetings should be held regularly. Conducting reliable research on stakeholder preferences increases the likelihood that the measures will be implemented successfully.

This article can contribute to a future Sulp for Gdynia and provide an example for other cities offering a set of measures and a methodology. The paper examined a chosen city's stakeholders' awareness and their attitude towards sustainable logistics measures based on a conducted survey. It focused on indicating the nature of the impact of factors

conditioning further actions related to the discussed area. The level of acceptability by individual stakeholders in urban space has a great influence on the effectiveness of implementing new solutions.

## Acknowledgments

The article is based on the results of research carried out as part of the Interreg project called TENTacle.

TENTacle – The Interreg project meant to provide public authorities and industries around the Baltic Sea with recommendations on how to benefit from the core transport network corridors to boost prosperity and growth. Its goals include stimulating the growth potential of the corridor entry/exit nodes, and developing last-mile infrastructure in and around urban nodes on the Baltic-Adriatic corridor. One of Gdynia's main aims for participating in the project is to analyze its needs related to transport node development in the city. The TENTacle project was aimed to help define what type of infrastructure and services are necessary for the better and faster development of Gdynia and the entire Baltic Sea Region, and what actions to take to maximize the advantage of the seaside location of a city (TENTacle, 2018).

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**Cite as:** Matusiewicz, M. & Rolbiecki, R. (2021) The tendency of city stakeholders to implement sustainable logistics measures using the port city of Gdynia as an example. *Scientific Journals of the Maritime University of Szczecin, Zeszyty Naukowe Akademii Morskiej w Szczecinie* 66 (138), 69–80.