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The Assumptions, Conditions and Barriers of the Development of the Urban Consolidation Centre for Municipal Entities (UCC-ME)

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Natalia Wagner[1], Stanisław Iwan[2], Kinga Kijewska[3]

Abstract:

Purpose: *The Urban Consolidation Centres (UCC) are well-known city logistics solutions. Many of their advantages are described in papers and reports. However, the practical implementation of this concept still seems to be a challenge for both business and municipal partners. The main aim of the paper is to develop a concept of a special type of UCC, focused on deliveries for municipal entities. The research includes an analysis of the possibilities of developing consolidated deliveries for municipal entities in a medium-size city - Stargard (Poland).*
Design/Methodology/Approach: *On the basis of survey research conducted in Stargard, assumptions and expectations regarding the efficient implementation and functioning of Urban Consolidation Centre for Municipal Entities (UCC-ME) were established. Business Model Canvas adapted to the needs of urban logistics was used to develop the most important features of the UCC-ME concept.*
Findings: *The results show that the concept of UCC-ME is a city logistics solution whose implementation should be based on a tailor-made business model, preceded by market research and the support of the city authorities. UCC-ME gives a city the opportunity to reduce the negative impact of urban freight transport on its environment and improve the safety of its residents.*
Practical Implications: *The results of this study can be used by local authorities to implement UCC-ME.*
Originality/value: *The original contribution of the paper is the development of the Business Model Canvas (BMC) of UCC-ME. The main novelty is that the proposed concept focuses on municipal entities only.*

Keywords: *Urban consolidation centre, urban freight transport, city logistics, sustainable city.*

JEL classification: *O18, R41, R58.*

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[1]*Maritime University of Szczecin, Poland, e-mail: n.wagner@am.szczecin.pl;*
[2]*Maritime University of Szczecin, Poland, e-mail: s.iwan@am.szczecin.pl;*
[3]*Maritime University of Szczecin, Poland, e-mail: k.kijewska@am.szczecin.pl;*

1. Introduction

Freight deliveries in cities involve a wide variety of challenges. Congestion, narrow areas for freight deliveries and a large number of stakeholders in a limited area contribute to reducing the efficiency of logistics systems. At the same time, freight deliveries contribute to a series of environmental problems, like poor air quality, noise and greenhouse gases emissions. To improve citizens' quality of life, it is necessary to frame and implement a city logistics strategy (Kiba-Janiak, 2020).

Analysing the impact of urban freight transport (UFT) measures is particularly important since improving the situation for freight deliveries will increasingly be at the expense of the citizens. For instance, designated spaces for loading/unloading operations in city centres will usually be at the expense of public parking spaces. Therefore, UFT solutions are to a considerable extent resisted by the public, and for this reason, local governments often give up on implementing such solutions. The approach of the authorities of Stargard (Poland), which is the object of research in this paper, seems to be a bit better. Municipal Authorities are interested in improving UFT system and are actively involved in creating tailor-made solutions.

The paper focuses on the identification of the advantages, barriers and determinants of functioning of urban consolidation centres in medium size cities, based on Stargard example. The main aim of the paper is to develop a concept of a special type of UCC, focused on deliveries for municipal entities. The proposed solution assumes the consolidation strategy, eco-friendly light commercial vehicles (electric drive in this case) and cargobikes to handle transport from UCC-ME. The combined use of eco-friendly delivery vans and cargobikes is recommended in the literature as the best scenario for inner-city freight transport (Aljohani and Thompson, 2019).

Moreover, the paper presents the drivers for the development of this kind of solution in the context of expectations in the field of management, technology, infrastructure and legislation, based on Poland example. The original contribution of the paper is developing the Business Model Canvas (BMC) of Urban Consolidation Centre for Municipal Entities (UCC-ME).

The paper is structured as follows. The starting point (Section 2) for the research is a critical analysis of the literature concerning functioning of UCC and characterising a strategic management tool – BMC – which is used for developing the UCC-ME concept. Section 3 provides an overview of the documents and presents the results of survey research on the structure of supply to the educational entities. Section 4 provides business model canvas (BMC) developed for UCC-ME in Stargard and analyses its expected impact on the air emission.

2. Theoretical Background

2.1 Urban Consolidation Centre as a Solution to Reduce Urban Freight Transport Negative Impact

An important alternative to the traditional system of goods delivery in the city is the use of a Urban Consolidation Centre. Utilizing UCC gives a chance to eliminate harmful environmental effects thanks to transporting freight by smaller-size and eco-friendly vehicles through the city areas. UCCs are believed to have the potential to reduce negative environmental impact and respond to social challenges of urban freight transport and, furthermore, can also potentially improve the efficiency of distribution systems and accelerate the use of more environmentally friendly vehicles (Allen *et al.,* 2012). Alternatively-powered vehicles, in particular those with electric motors, will play an increasingly important role in the development of urban freight transport (Iwan *et al.,* 2014), and UCCs could give impetus to such changes.

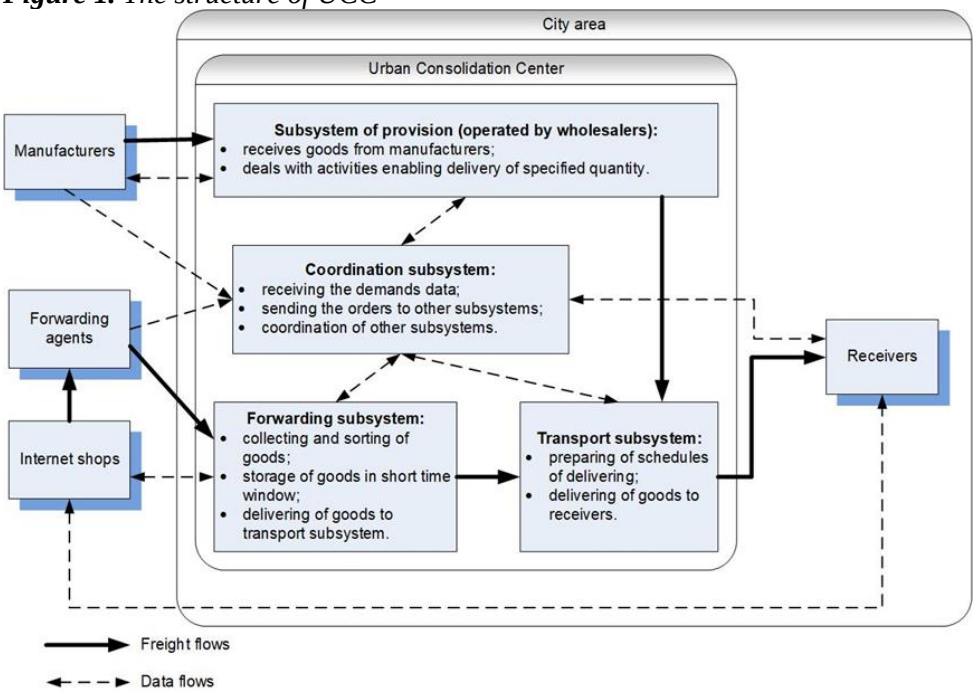
The term "urban consolidation centres" has several different meanings, like, among others: public distribution depot, central goods sorting point, urban transhipment centre, shared-user urban transhipment depot, freight platforms, cooperative delivery system, consolidation centre (sometimes specific, e.g., retail, construction), or urban distribution centre (Browne *et al.,* 2005). It can be defined as a logistical base often located close to the place where services are provided (e.g., city centres, shopping centres), where many entrepreneurs deliver goods intended for the serviced area from which consolidated deliveries are made, as well as additional logistics and commercial services (Allen *et al.,* 2007). The location of consolidation facilities largely depends on the specificity of the final delivery area and the entire city. They can be based either in the city centre, on the outskirts (Allen *et al.,* 2012) or, for example, in a seaport (Wagner, 2019). The major tasks of UCC are focused on goods reception, sorting, storage, and loading on other means of transport. Moreover, these facilities can realize some additional tasks, like setting prices and fees, reverse logistics, home delivery, and services of collecting wastes.

The freight delivery realization without utilizing UCC is based on direct delivery of products to the receivers. It generates a significant number of vehicles' journeys through the city area and, following that, negative results for the city environment. Urban Consolidation Centre allows to eliminate these problems. Products are transported from suppliers by large trucks directly to Urban Consolidation Centre, where they are sorted and delivered in a consolidated form to recipients by appropriate means of transport. It is possible to point out four major subsystems in the structure of UCC (Figure 1):

- subsystem of provision (operated by wholesalers) – receives goods from manufacturers, deals with activities enabling delivery of specified quantity, assortment and quality of goods with the aspect of time taken into

consideration (this refers mainly to the delivery of food, cleaning and hygienic articles);
- forwarding subsystem – dealing with collecting, sorting and storage of deliveries and directing them to transport subsystem; subsystem appears especially important with orders made electronically;
- transport subsystem (distribution) – it undertakes and performs activities ensuring customers to obtain their deliveries on time, divides town areas into zones which prevents the delivery routes from crossing with each other while supplying goods; vehicles delivering goods often operate in zones with particularly stringent requirements concerning the limitation of noise and pollutant emissions, therefore the subsystem should be based on environmentally friendly technologies (e.g. vehicles with electric or hybrid propulsion)
- coordination subsystem.

Figure 1. *The structure of UCC*

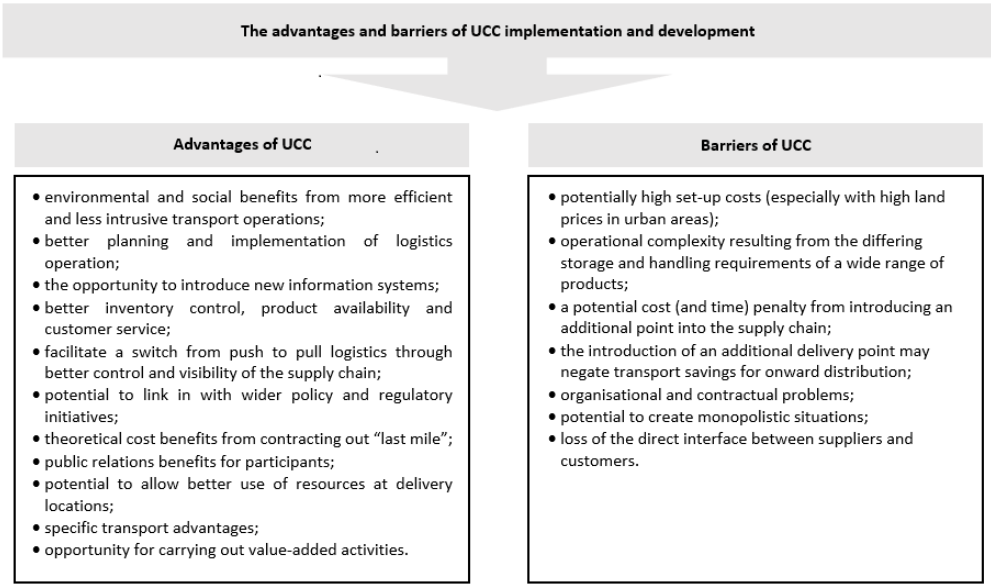


Source: *Own study.*

This concept has many advantages, especially taking into account the environmental efficiency. Nevertheless, it is important to highlight some general barriers of its implementation. The major problem is the high cost of both implementation and development processes. There are some experiences in Europe, when the UCC initiatives have been realized under the international or local projects support. However, after the projects periods the initiatives stopped. Implementing and maintaining UCC is a big challenge for cities. Ways for their successful and long-

run functioning are still being sought (Akgün *et al.*, 2020; Reis *et al.*, 2019; van Heeswijk *et al.*, 2019). Figure 2 introduces the advantages and barriers of UCC implementation and development.

Figure 2. *The advantages and barriers of UCC implementation and development*



Source: *Own study based on Allen et al., 2007.*

For the proper and long-term functioning of UCC, it is necessary to take into account the expectations of various stakeholders, their involvement in the activities of the centre and a change in the relationship between supply chains actors (Grandval *et al.*, 2019). Types of stakeholders are mostly identified as: local authorieties/government, receivers, logistic service providers, suppliers, UCC operators, residents and research institutions (Björklund and Johansson, 2018). Individual stakeholders often adopt their own perspective and pursue their own goals, which makes cooperation between them difficult in the process of implementing new solutions in the area of urban logistics (Taniguchi and Tamagawa, 2005). The design and running of UCC can be considered a test of cooperation for efficient urban freight transport (Lagorio *et al.*, 2016; Johansson and Björklund, 2017).

2.2 General Idea of Urban Consolidation Centre for Municipal Entities

Urban Consolidation Centres can be divided into several categories (Chwesiuk, 2008; Allen *et al.*, 2014). The idea of UCC-ME (Urban Consolidation Centre for Municipal Entities) is based on the local UCC concept. The major difference comparing to a typical UCC is that the proposed concept is focused on the municipal entities only. Due to that many barriers and problems related to UCC idea will be significantly reduced or minimized.

There are various factors for the successful implementation of UCC of which the most important are the institutional ones such as leadership, operational agreement, financial support, obligation of stakeholders to participate, interaction with the logistics network, and the operational ones including customer demand, truck load factor, and vehicle type (Lin *et al.*, 2016). Among them, the most problematic issue for the long-term functioning of UCC is to find the best way to finance it (Ros-McDonnell *et al.*, 2018). High operating costs are the main cause of UCC failure (Lagorio *et al.*, 2018).

UCC-ME is related to the municipal structure and should be included in it. Therefore, the operational costs will be cover under the municipal budget. For the remaining shareholders, this means that the most important barrier can be reduced. From the other side, it will be necessary to establish the additional organisational unit in the organization structure of the Municipal Office for UCC-ME administration. The other option is to sign the agreement with the external subcontractor to provide the management services under UCC-ME.

2.3 Using Business Model Canvas for City Logistics Purposes

The term business model is commonly used by managers and scholars, however, it has no generally accepted definition in the literature. As a result, its meaning and understanding is not always the same (DaSilva and Trkman, 2014). Definitions often propose a unique set of decision variables or components for characterizing a business model, usually regardless of venture type (Morris *et al.*, 2005). A list of important aspects, among others, consist of "roles and relationships among a firm's customers, allies and suppliers, and it identifies the major flows of product, information, money, as well as the major benefits to participants" (Weill and Vitale, 2001). Another of the most well-known business model definitions says that "it describes the rationale of how an organization creates, delivers, and captures value" (Osterwalder and Pigneur., 2010). The authors of the above definition propose to create a business model using a practical tool - the business model canvas (BMC).

This tool has become very popular because of its simplicity, clear structure and attractive visual form that includes all vital components in one sheet. The process of creating the BMC is a subject of numerous trainings and workshops for entrepreneurs, managers and strategists, as well as a tool used in research papers (Trigkas *et al.*, 2020; Polydoropoulou *et al.*, 2020; Fritscher and Pigneur, 2014). Consulting companies offer their help in creating and modifying the business models with the use of BMC, so that they would increase company's chances of success.

The BMC can be used for various types of organizations functioning in numerous industries. The BMC allows a manager or researcher to identify, categorize and better organize the most important elements of various types of business models. It can be applied not only to profit-oriented enterprises, but also to other types of projects, for example those initiated by the city authorities and aimed at solving

logistic problems. There are several examples of applying BMC to develop solutions in the area of logistics (De Marco *et al.*, 2017; Pratama and Iijima, 2018; Alias *et al.*, 2015). The logistic solution proposed for Stargard is not profit-oriented, however the BMC suits perfectly because it helps include all elements, sort them correctly and thanks to that make the idea closer to the realization process. The BMC sheet, that is used in this paper have been modified according to (TURBLOG, 2011; Quak *et al.*, 2014) to better suit urban logistic projects and solutions. The difference is adding one more building block called "Externalities". As a result the tool consists of 10 instead of 9 blocks. The added block is located in the central part of the canvas. Its location close to "value proposition" highlights the importance of ecological and social matters in the whole logistic project.

3. Data, Scope and Research Approach

3.1 Regional Goals and Long Term Future Vision for Stargard

A sustainable city can be defined as the spatial entity that maximises the benefits in economic and social dimensions under relevant constraints on environmental and socio-economic limitations (Mori and Yamashita, 2015). The use of the sustainable city concept based on sectoral approach includes not only transport but also housing, land-use, natural environment, employment, public services (Maclaren, 1996). The choice of areas, methods and tools that constitutes a sustainable city is determined by cities authorities (Lombardi *et al.*, 2011; Kenworthy, 2006). The authorities of Stargard, the city that is the subject of research in this paper, have the ambition to manage the city to strengthen its sustainability.

Stargard is a city situated in the north-western Poland, West Pomerania Region. It is the third city in the region in relation to population (68 thousand inhabitants) and economy (Local Data Bank, 2020). Stargard is a rapidly growing city which results in an increase of number of cars in the region and increasing carbon dioxide emissions. It is expected that creating the UCC-ME could help reduce the congestion, noise and pollutions in the major areas of the city.

The UCC-ME concept is consistent with the guidelines for the development of the city, in particular its transport system development plans, included in the city's strategic documents, as well as the vision of further development of the city. Goals and future vision for Stargard are given in the document Social and Economic Development Strategy for Stargard City (Stargard, 2016). It includes the Mission of Stargard, which says that sustainable development in the harmony with economic, social and natural environment is necessary for the present and the future of Stargard. Stargard's vision and development objectives correspond to the targets at the regional level, which are included in Development Strategy of West Pomerania Region till 2020 (West Pomerania Region, 2019). The document consists of several aims and targets, some of them refer also to urban transport solutions.

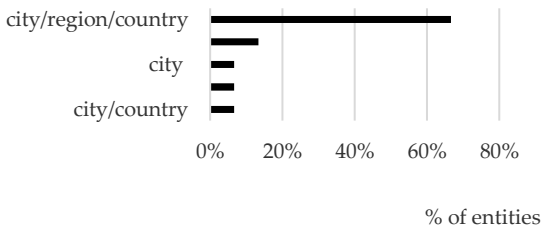
UCC-ME in Stargard is focused mainly on goods deliveries to educational entities. That is why the population of children under the age of 14 and future trends in that field are especially important. In 2017 there was an increase of that population group by 0,8% comparing to 2015 (Local Data Bank, 2020). In some districts of Stargard high people density results in transportation problems that can be solved by UCC-ME. Some educational entities which are situated inside tower-block housing estate (Os. Zachód) share joint problem with road infrastructure. Schools are surrounded by blocks of flats and the roads leading to them are very narrow. As the result streets are always packed with cars. Narrow street full of parked cars can lead to an organizational trouble for suppliers and more time spent on maneuvering which means more air emissions and noise close to the school buildings. Moreover, they can have a negative impact on children's safety when several deliveries are made at the same time.

3.2 Identification of Routine Supplies for Municipal Entities

In order to examine the situation in Stargard and identify the needs of municipal entities, a questionnaire study was performed among the managers of schools and kindergartens that have been chosen in cooperation with Municipal Authorities. The survey has been conducted in September 2017. The survey consisted of 12 questions, some of which were of a general nature, which allowed the managers to express their expectations towards the UCC-ME concept, while the more detailed part concerned the logistic aspects of the deliveries. The survey allowed to identify the needs of municipal entities and analyze the supply strategy of these units.

One of the first questions in the survey concerned the location of supply sources for educational entities. Figure 3 shows that the kindergartens and schools are mainly supplied by companies located outside the city. It indicates that only one kindergarten purchased goods only from suppliers coming from inside the city, while all others represented various combinations of suppliers' locations. The obtained result speaks in favor of the implementation of the consolidation of supplies from outside the city, and then distributing them to specific municipal entities within the city.

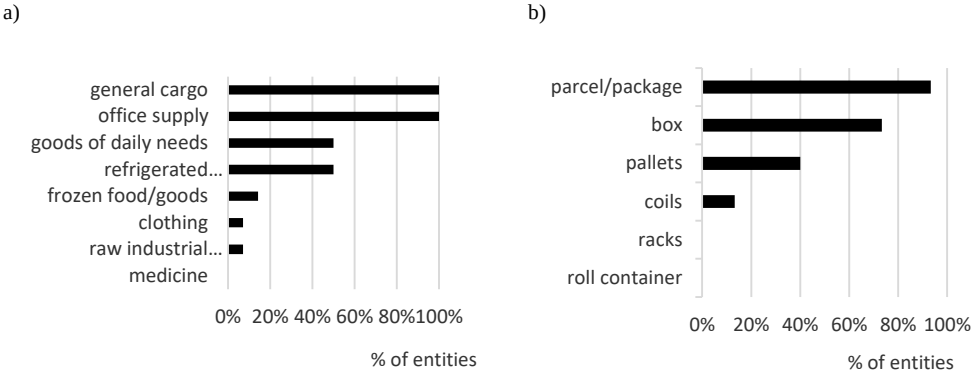
Figure 3. *Origin of supply*



Source: *Own work.*

Another interesting information, important for the proposed solution, is the type of goods in typical shipments (Figure 4a) and cargo units that are used to transport them (Figure 4b).

Figure 4. *Shipments characteristics: a) Types of goods in typical shipments; b) Cargo units used in typical shipment.*



Source: *Own study.*

The obtained data show that the goods purchased by the surveyed entities are mainly classified into two groups - general cargo and office supply. The vast majority of loads are delivered in the form specified as: parcel/package and box. The weight of these consignments is usually less than 30 kg.

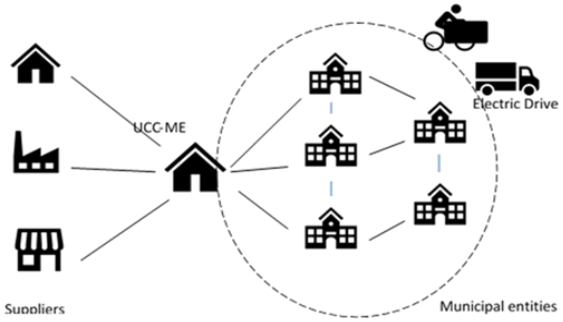
The conducted analysis showed that both dimensions - spatial location of suppliers and typical cargoes - are suitable to consolidate and then to distribute them to the surveyed units using cargo bicycles. The survey also showed that when launching UCC-ME, it will be necessary to create a common supply plan for all entities participating in the system. Deliveries to municipal entities are fairly regular and, at the same time, their managers represent a flexible approach to adjust their delivery times so that the entire system can run efficiently.

4. Results

4.1 Business Model Canvas for UCC-ME

The concept of Urban Consolidation Centre for Municipal Entities (UCC-ME) in Stargard is related to the strategic documents and general vision of Stargard as a city offering good conditions for living. The reduction in the number of deliveries will help to decrease the traffic inner the city centre and will influence on less pollutions and noise. The most important is that the deliveries from (UCC-ME) to the municipal entities will be realized with utilization of environmental friendly vehicles (electric vans or cargo e-bikes). The concept of UCC-ME is presented in Figure 5.

***Figure 5**. The idea of UCC-ME*



***Source:** Own study.*

UCC-ME in Stargard will provide services to several public entities located in the city. Presently freight deliveries in Stargard are realised directly from suppliers to receivers. They are managed separately and are not coordinated with each other. Because each delivery is carried out independently, it generates negative results for the city environment due to increased number of vans or trucks. Developing the concept of UCC-ME allows these problems to be eliminated. BMC for UCC-ME is presented in Figure 6.

***Figure 6.** Business Model Canvas for UCC-ME*

Key Partners
- Municipal authorities
- Municipal entities (schools, kindergartens etc.)
- UCC-ME operator
- A courier company (electric car/cargo bike)

Key Activities
- Last mile deliveries between UCC-ME and municipal entities
- Short-term storage in UCC-ME
- Acquiring new customers

Key Resources
- UCC-ME place
- UCC-ME staff
- Purchase coordination system
- Route planning management

Value proposition
- Better organised and eco-friendly deliveries
- Less vehicles close to schools and kindergartens
- Convenient delivery time
- Time saved on not entering the city centre
- Last mile deliveries done only by a dedicated courier

Externalities

Congestion, noise and pollution reduction

Customer Relationships
- Long-run relationships
- Obligatory for educational municipal entities

Channels
- Online and telephone booking
- Face to face contact with a courier driver

Customer Segments
- Municipal entities (schools, kindergartens, Social Welfare Centre etc.)
- City Hall
- Suppliers of industrial goods
- Local residents

Cost Structure
- Facility maintenance
- Payments for bike/electric vehicle courier company
- Salary for UCC-ME employee

Revenue Streams
- City's own financing
- Fees

***Source:** Own study.*

The following elements can be found in BMC:

1. Customer segments: They can be divided into directly and indirectly involved

groups of customers. Directly involved customers are:

- Receivers and senders - they use freight transport every day, as they obtain and send a huge number of parcels, which enable all the entities to function properly. Presently there are 14 objects chosen: 4 kindergartens, 9 primary schools (3 of them with junior school classes) and the Town Office. Municipal entities act mainly as receivers, although they can also combine both roles.
- Senders - suppliers of industrial goods.

Apart from mentioned above two main groups of customers there is also a group of indirectly involved stakeholders – local residents. It is important not to forget them and place them in this part of the BMC, because they are the main target of all actions taken by the city authorities.

2. Customer relationships: Municipal authorities have ownership and supervisory competencies in relation to municipal educational entities. That is why participation in UCC-ME project for these entities could be obligatory. Every partner expects long-term cooperation. Only this approach - long-term cooperation based on mutual trust and appreciation of the sustainable development promoted by the Stargard city - is the basis for the effective implementation of the solution. If there are positive results, such as more efficient organisation of deliveries and socio-economic benefits, further actors may be encouraged to join UCC-ME. It is believed that price and quantities of delivered goods will remain the same.
3. Value proposition: For Municipal Authorities and educational entities the most important are better organized, synchronized and eco-friendly deliveries. It is also important to adjust the delivery time to daily routine of these entities to avoid deliveries when children are coming to kindergarten or school. Deliveries will be split into two processes – to and from UCC-ME. Suppliers will focus on deliveries to the UCC-ME whereas last mile deliveries will be performed only by a dedicated courier company. Suppliers (or transport providers employed by them) can be positively affected by saving delivery time through avoiding inefficient last mile deliveries. Local residents will be provided with a more attractive, less polluted area with fewer freight vehicles. UCC-ME operator and courier company will have opportunity to make a profit.
4. Key activities: A key part of UCC-ME business model is to provide last mile deliveries between UCC-ME and municipal entities. It will be also possible to offer short-term storage of goods in UCC-ME. It is important to involve more entities in the solution, so appropriate marketing action will be performed.
5. Channels: Presently customers are supplied without UCC-ME, so often the choice of transport means is an incidental decision. After implementing UCC-ME the transport will be coordinated and will be realized with utilization of environmental friendly vehicles (electric vans or cargo e-bikes). Contact with customers will be provided by: online and telephone booking or face to face contact with a courier (bike and electric car) driver.
6. Key resources: They are necessary to run UCC-ME and can be divided into two parts. The first part consist of material and human resources:

- UCC-ME place – a small consolidation point where goods will be received for short-term storing and sorted for deliveries. Most likely, the existing building belonging to the municipal authorities will be used.
- UCC-ME staff – an employee who will manage the consolidation point.

The second part is intellectual values and resources:

- Purchase coordination system – it will help organize the process of buying goods for all entities together,
- Route planning management – it will optimize distribution of goods and documents between UCC-ME and public entities.

7. Key partners: The most important partners who will create the entire UCC-ME system will be:
   - Municipal authorities – they play a key role in the whole project. They have ownership and supervisory competencies in relation to municipal educational entities. Thanks to that they can easily ask entities to change their purchasing management and participate in UCC-ME. They also will provide a facility for UCC-ME.
   - Municipal entities - kindergartens, primary schools, secondary schools, high schools, Vocational School Complexes, Social Welfare Centre and others. They will be main receivers of goods shipped through UCC-ME.
   - Suppliers of industrial goods – at present they deliver goods to municipal entities and City Hall directly. After implementation of UCC-ME they will deliver goods through that facility.
   - UCC-ME operator– Municipal Authorities are not interested in running the centre by themselves. A private company or private-public partnership are considered.

   A courier company (electric car/bicycle) which will be responsible for deliveries between UCC-ME and municipal entities. The company make a contribution through its transport means and drivers.
8. Cost structure: The most expensive parts are:
   - Facility maintenance,
   - Payments for bike/electric car courier company,
   - Salary for UCC-ME employee (one employee at the beginning of UCC-ME functioning).
9. Revenue streams: One of the most important questions encountered when creating the business model canvas is whether the UCC-ME will be able to finance itself. At the beginning of the operation, financial support of the city will certainly be necessary. Stargard Authorities are considering their own financial contribution, however they would prefer to involve a private company to run a newly designed consolidation centre. One of possible option is to create a Private-Public Partnership to finance the realization of the concept. The final decision will certainly depend on the willingness of suppliers to participate in the system (including payment of fees). They could benefit, for example, from better organisation of supplies.
10. Externalities: In fact this part of business model canvas is crucial to understand the main aim of UCC-ME. The positive impact on the environment and society,

which will be achieved through the activities of UCC-ME, is the main goal of implementing UCC-ME. UCC-ME will help reduce the congestion, noise and pollutions in the major areas of the city. Traffic safety and quality of life in city centre is expected to be improved.

4.2 Assessing the Impact of UCC-ME on Urban Environment

To assess the effect of using environmentally friendly vehicles for making deliveries from UCC-ME to municipal entities, two scenarios were analyzed. The first one assumes the use of cargo bikes and electric LCV (Light Commercial Vehicles) that operate without exhaust emissions, while the second assumes that the same shipments will be made using conventional LCVs. Comparison of both scenarios allows examining the amount of air pollution that would not be emitted to the atmosphere in Stargard. When creating the transport schemes, the origin-destination matrix was adapted, which is a method to specify the demand for the trips between the origin and destination nodes in the network (Kijewska and Iwan, 2016). The analysis assumes several round trips, the start and end of which is always in the City Hall (CH), as this is the location of UCC-ME pre-determined by the authorities of Stargard. The distance covered in each round trip is presented in Table 1.

Table 1*. Distances for round trips included in the study*

Round trip	Distance (km)
CH – PS_6 – K_4 – PS_1 – K_3 – PS_9 – PS_3 – CH	10.0
CH – K_2 – PS_4 – K_1 – PS_2 - CH	5.4
CH – PS_5 – PS_7 - CH	11.3
CH – PS_i – CH; where i=1-9	0.5 – 11.1
CH – K_i – CH; where i=1-4	1.6 – 5.4

Source: *Own study. Symbols: CH – City Hall, K – Kindergarten, PS – Primary School.*

The first three routes are longer and each comprises several primary schools (PS) and kindergartens (K). These routes are constructed based on the proximity of these objects to each other. Additionally, the study also includes shorter round trips, dedicated to a particular primary school or kindergarten. The average distance for all trips together is 5.2 km. In order to calculate the emissions in the analysed scenario, 4 trips per week were assumed during the year. The calculations are presented in Table 2.

Table 2*. Air emission calculated in the study for the conventional LCV*

Average distance (km)	Number of trips per year	Distance during the year (km)	Average air emission of LCV in urban freight transport in Poland (gram/km)				Air emission of conventional LCV (gram)			
			PM	NO_X	CO	CO_2	PM	NO_X	CO	CO_2
5.2	208	1081.6	0.17	1.29	3.45	314.4	229.8	1744.1	4664.4	425068.8

Source: *Own study based on Kijewska & Iwan, 2016; European Environment Agency, 2013.*

The results show that the most important premise for involving cargo bikes and electric LCV in the concept of UCC-ME, which is the possibility of reducing the negative impacts of urban freight transport on the city environment, would be met. Calculated emissions that do not enter the atmosphere should be considered as a minimum plan. The research is based on the assumption that shipments will be carried out only to several objects. The research should be considered as preliminary, pilot study. If interest in UCC-ME participation is confirmed, this solution could include further municipal entities. In that case, the calculated reduced emissions would be higher.

5. Conclusions

The Stargard authorities are the initiator of seeking a solution for logistics problems in the city and their support is of key importance in the implementation phase of UCC-ME. The aim of the analyzed logistics solution is to improve the quality of life of Stargard residents. The implementation of UCC-ME can reduce the number of medium and large vehicles in the city centre and consequently reduce pollution, congestion and noise. What is more, it can also improve the safety of children around schools and kindergartens. Several steps toward establishing UCC-ME have already been done, many of which with the support of the authorities. Apart from conceptual research, some experiments were also carried out (Nürnberg, 2019). The biggest challenge for the municipality is to find the best way to organize and finance the activities of UCC-ME.

The implementation of this kind of solution should be preceded by an analysis of some more detailed managerial issues, like organizational structure, financing model, type of cooperation with the suppliers, the establishment of the integrated purchasing process for municipal entities. During the next steps of planning and decision process, these issues will be considered by both, the researchers and the municipality representatives. The biggest barrier will be to obtain financial support for the creation of UCC-ME. This step lies in hands of Municipal Authorities of Stargard. It is crucial for the success of the whole initiative that UCC-ME becomes economically self-sufficient after the necessary support of the Authorities at the beginning of its operation.

References:

Akgün, E. Z., Monios, J., Fonzone, A. 2020. Supporting urban consolidation centres with urban freight transport policies: a comparative study of Scotland and Sweden. International Journal of Logistics Research and Applications, 23(3), 291-310.

Alias, C., Goudz, A., Jawale, M., Noche, B. 2015. Generating a business model canvas for Future-Internet-based logistics control towers. 4th IEEE International Conference on Advanced Logistics and Transport, IEEE ICALT 2015, 7136592, 257-262.

Aljohani, K., Thompson, R.G. 2019. A Stakeholder-Based Evaluation of the Most Suitable and Sustainable Delivery Fleet for Freight Consolidation Policies in the Inner-City Area. Sustainability, 11(1), 124.

Allen, J., Browne, M., Woodburn, A. Leonardi, J. 2014. A Review of Urban Consolidation Centres in the Supply Chain Based on a Case Study Approach. Supply Chain Forum: An International Journal, 15(4), 100-112.

Allen, J., Browne, M., Woodburn, A., Leonardi, J. 2012. The Role of Urban Consolidation Centres in Sustainable Freight Transport. Transport Reviews, 32(4), 473-490.

Allen, J., Thorne, G., Browne, M. 2007. BESTUFS. Good Practice Guide on Urban Freight Transport. BESTUFS consortium, www.bestufs.net.

Björklund, M., Johansson, H. 2018. Urban consolidation centre - a literature review, categorisation, and a future research agenda. International Journal of Physical Distribution & Logistics Management, (8), 745-764.

Browne, M., Sweet, M., Woodburn, A., Allen, J. 2005. Urban Freight Consolidation Centres. Final Report. Transport Studies Group. University of Westminster, Available from: http://www.freightbestpractice.org.uk/urban-freight-consolidationcentre-report.

Chwesiuk, K. 2008. Urban Consolidation Centre as a part of city logistics. Logistics, 4.

DaSilva, C.M., Trkman, P. 2014. Business Model: What it Is and What it Is Not. Long Range Planning, 47, 379-389.

De Marco, A., Mangano, G., Zenezini, G., Cagliano, A., Perboli, G., Rosano, M., Musso, S. 2017. Business Modeling of a City Logistics ICT Platform. Proceedings - International Computer Software and Applications Conference, 2, 8030030, 783-789.

European Environment Agency: Road user charges for heavy goods vehicles – Tables with external costs of air pollution. 2013. EEA Technical Report. Available at: https://www.eea.europa.eu/publications/road-user-charges-for-vehicles.

Fritscher, B.E, Pigneur, Y. 2014. Visualizing Business Model Evolution with the Business Model Canvas: Concept and Tool. Proceedings - 16th IEEE Conference on Business Informatics, 1, 6904149, 151-158.

Grandval, S., Nimtrakool, K., Grant, D.B. 2019. Factors of adoption governing the emergence of urban consolidation centres. Supply Chain Forum: An International Journal, 20(4), 247-265.

Iwan, S., Kijewska, K., Kijewski, D. 2014. Possibilities of Applying Electrically Powered Vehicles in Urban Freight Transport. Procedia – Social and Behavioral Sciences, 151, 87-101.

Johansson, H., Björklund, M. 2017. Urban Consolidation Centres: Retail Stores' Demands for UCC Services. International Journal of Physical Distribution & Logistics Management, 47(7), 646-662.

Kenworthy, J.R. 2006. The eco-city: Ten key transport and planning dimensions for sustainable city development. Environment and Urbanization, 18(1), 67-85.

Kiba-Janiak, M. 2020. Comparative Analysis of Selected European Cities's Potentials to Influence the Formulation and Implementation of Logistics Strategy. European Research Studies Journal, XXIII (1), 586-599.

Kijewska, K., Iwan, S. 2016. Analysis of the functioning of urban deliveries in the city centre and its environmental impact based on Szczecin example. Transportation Research Procedia, 12, 739-749.

Lagorio, A., Pinto, R., Golini, R. 2016. Research in Urban Logistics: A Systematic Literature Review. International Journal of Physical Distribution & Logistics Management, 46(10), 908-931.

Lin, J., Chen, Q., Kawamura, K. 2016, Sustainability SI: Logistics Cost and Environmental Impact Analyses of Urban Delivery Consolidation Strategies. Networks and Spatial Economics,16(1), 227-253.

Local Data Bank, Statistics Poland, available at: www.stat.gov.pl.
Lombardi, D.R., Porter, L., Barber, A., Rogers, C.D. 2011. Conceptualising sustainability in UK urban regeneration: A discursive formation. Urban Studies, 48(2), 273-296.
Maclaren, V.W. 1996. Urban Sustainability Reporting. Journal of the American Planning Association, 62(2), 184-202.
Mori, K., Yamashita, T. 2015. Methodological framework of sustainability assessment in City Sustainability Index (CSI): A concept of constraint and maximisation indicators. Habitat International, 45(P1), 10-14.
Morris, M., Schindehutte, M., Allen, J. 2005. The Entrepreneur's Business Model: Toward a Unified Perspective. Journal of Business Research, 58, 726-735.
Nürnberg, M. 2019. Analysis of using cargo bikes in urban logistics on the example of Stargard. Transportation Research Procedia, 39, 360-369.
Osterwalder, A., Pigneur, Y. 2010. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. New Jersey.
Polydoropoulou, A., Pagoni, I., Tsirimpa, A., Roumboutsos, A., Kamargianni, M., Tsouros, I. 2020. Prototype business models for Mobility-as-a-Service. Transportation Research Part A: Policy and Practice, 131, 149-162.
Pratama, N.R., Iijima, J. 2018. DEMO Construction Model Generation Process from Business Model Canvas. Proceedings of the 20th International Conference on Enterprise Information Systems (ICEIS 2018), 384-392.
Quak, H., Balm, S., Posthumus, B. 2014. Evaluation of City Logistics Solutions with Business Model Analysis. Procedia - Social and Behavioral Sciences, 125,111-124.
Reis, V., Escarameia, A., Macário, R. 2019. Improving distribution of freight in Lisbon downtown - Perspectives on the implementation of an urban consolidation centre to serve the HORECA segment, Revista Portuguesa de Estudos Regionais, 50, 85-101.
Ros-McDonnell, L., de-la-Fuente-Aragón, M.V., Ros-McDonnell, D., Cardós, M. 2018. Analysis of freight distribution flows in an urban functional area. Cities, 79, 159-168.
Stargard. 2016. Social and Economic Development Strategy for Stargard City. Available at: http://bip.gmina.stargard.pl/strony/2260.dhtml.
Taniguchi, E., Tamagawa, D. 2005. Evaluation City Logistics Measures considering the Behavior of Several Stakeholders. Journal of the Eastern Asia Society for Transportation Studies, 6, 3062-3076.
Trigkas, M., Anastopoulos, C., Papadopoulos, I., Lazaridou, D. 2020. Business model for developing strategies of forest cooperatives. Evidence from an emerging business environment in Greece. Journal of Sustainable Forestry, 39(3), 259-282.
TURBLOG. 2011. Transferability of urban logistics concepts and practices from a worldwide perspective, Deliverable 2: Business Concepts and Models for urban logistics.
van Heeswijk, W., Larsen, R., Larsen A. 2019. An urban consolidation center in the city of Copenhagen: A simulation study. International Journal of Sustainable Transportation, 13(9), 675-691.
Wagner, N. 2019. Sustainability in port cities - A bibliometric approach. Transportation Research Procedia, 39, 587-596.
Weill, P., Vitale, M.R. 2001. Place to space: Migrating to eBusiness Models. Boston, Harvard Business School Press.
West Pomerania Region. 2019. Development Strategy of West Pomerania till 2020, available at: http://eregion.wzp.pl/strategie/strategia-rozwoju-wojewodztwa-zachodniopomorskiego.