



Volume 100

2018

p-ISSN: 0209-3324

e-ISSN: 2450-1549

DOI: <https://doi.org/10.20858/sjsutst.2018.100.3>



Journal homepage: <http://sjsutst.polsl.pl>

Article citation information:

Dydkowski, G. The application of just distribution theories to financing integrated systems of regional and urban public transport. *Scientific Journal of Silesian University of Technology. Series Transport*. 2018, **100**, 23-33. ISSN: 0209-3324.

DOI: <https://doi.org/10.20858/sjsutst.2018.100.3>.

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**THE APPLICATION OF JUST DISTRIBUTION THEORIES TO
FINANCING INTEGRATED SYSTEMS OF REGIONAL AND URBAN
PUBLIC TRANSPORT**

Summary. The paper presents how to apply and use principles of the non-market allocation of goods and distribution in public transport systems. In most countries, regional and local public transport is a public service, whose availability should be ensured, with originating deficits financed by the public authorities. In the course of this service provision, problems can result from financing the deficit by various entities, e.g., municipalities and municipality groups, as well as participation by district and voivodeship self-governments in agreements related to the common organization of public transport and unified tariff-ticket systems. Based on local justice theory, this paper sets out principles that can be the foundation of deficit financing system development, including the analysis of their practical application to financing integrated public transport systems.

Keywords: financing; public transport; theories of local justice.

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1. INTRODUCTION

As a result of the expansion of urbanized areas, journeys and public transport lines do not end within administrative boundaries of cities, but also encroach into suburban areas. Thus, it becomes impossible to organize and manage public transport within one municipality. In turn, it is necessary to create appropriate structures or conclude relevant agreements. The determination of financing principles for the performed tasks concerns elements, which should be regulated in the statute of a supramunicipal institution or the concluded agreement.

The issue of establishing centralized funds for urban public transport financing is important from the point of view of ensuring effectiveness and economy in public spending. However, it has not been sufficiently studied so far in the economic literature, in particular, in relation to urban public transport. This results partly from financing public transport in certain European countries by local governments with a larger territorial scope (departments, voivodeships, regions or government administrations, even state budgets), and partly from the fact that suburbanization processes and expansion of daily commuting and servicing by public transport have a short history. This problem is also omitted because it is situated at the interface between economics, city management and economics of transport. When considering the practical importance of the aforementioned issue, it is apparent that research on principles of financing is necessary in order to ensure the economy of public funds spent on public transport.

2. ISSUES OF COST AND BENEFIT DISTRIBUTION IN COMMON PROJECTS

Urban public transport is financed from funds originating from the tariff revenues and from municipality budgets. In the case of urban transport integration, where, within one system, more municipalities are served or tickets are offered, enabling use of transport services provided by various entities, cash flows originate between them. Therefore, rules should be determined for the distribution of:

- deficit originating from urban public transport provision (difference between tariff revenues and costs) and among entities financing public transport from public funds
- tariff revenues from integrated (common) tickets between organizers and operators

When carrying out a review of deficit and tariff revenue distribution between various entities in the urban transport system, it is possible to state that, in many countries worldwide, simplified settlement systems are used. This generates a reluctance to conclude such contracts and hence imposes a barrier on tariff integration. As a result, tariff integration occurs most often if funds are distributed between public entities, or if they have the same owner. But, even in such a case, there is concern about the improper distribution of those funds and aversion to a specific solution. In other words, this situation represents a limitation, compared with expansion of ticket types or involved entities. This is not a system adapted to market liberalization and the existence of various ownerships; most frequently, operators issue different tickets.

The establishment of entities responsible for public transport organization and the conclusion of agreements on entrusting one municipality with tasks of urban public transport organization require principles to be defined, in terms of financing. In Poland, organizers are entities established according to the Act on Municipal Local Government (intermunicipal unions) or operating based on provisions of the Act on Public Finance (budget establishments

or entities). They operate based on financial plans, while the cities' contributions depend on various parameters. Most often, this is the operational work (number of vehicle-kilometres) or the actual deficit generated by individual transport lines. In turn, payment for transport service performance is made based on the size of the operational work; the unit rate is determined as a result of tender procedures or, in the case of internal operators, in a way specified in the Regulation (EC) No 1370/2007 of the European Parliament and of the Council of 23 October 2007 on Public Passenger Transport Services by Rail and by Road and Repealing Council Regulations (EEC) Nos 1191/69 and 1107/70.

The adopted principles for defining the shares in the common activity costs and the amount of financing should meet requirements related to public financing use, as an instrument to control public transport, as well as enable the preparation of forecasts and long-term development plans and the making of investment decisions. It is also necessary to ensure the explicitness and transparency of settlements between supramunicipal organizers and municipalities. Issues of a general nature overlap with expectations of justice, municipality solidarity as well as the necessity to pursue improvements in the public spending effectiveness. The issues of cost or benefit distribution related to common projects are not complex; as they frequently occur in practical activities, it is necessary to develop and apply specific rules of conduct.

Cities establishing a supramunicipal entity or concluding an agreement to organize urban public transport in order to obtain benefits related to the transport integration. In particular, tariff and transport offer management integration should be mentioned here. Tariff integration facilitates the use of urban public transport, which strengthens its competitive position with respect to travel by private car. It also enables transfers between various lines and means of transport, which in turn allows for transport to be facilitated in such a way as to eliminate substitutive transport lines and prevent an oversupplied offer on certain sections of routes, as well as reduce passengers' aspirations for direct connections. The transport offer is concerned with integration, expansion of the area and, in particular, the involvement of many transport entities, which leads to benefit resulting from timetable coordination on various lines and means of transport. This includes the market verification of bus transport service provision, a reduction in substitutive lines, and the division of transport tasks in a way reflecting the transport capability and other parameters, so that the expected transport service can be delivered. Moreover, it is possible to achieve economies of scale related to transport organization in a larger area [4,5].

However, identifying benefits itself, of which a part is immeasurable or difficult to measure in terms of money, is not enough. Decision-making about solutions most often requires the consideration of costs and benefits [8], including external costs and benefits. The economic effect is significant from the solution durability point of view as well.

Provisions in the Act of 29 August 2009 on Public Finance apply to municipalities [1]. Pursuant to Article 44, Paragraph 3, public expenditure shall be carried out in a purposeful and economical way, maintaining the principle of obtaining the best effects from specific outlays and of the optimal selection of methods and measures used to achieve the intended goals (Subparagraph 1). Hence, the establishment of a supramunicipal public transport organizer shall provide benefits to all participants. This can result from obtaining additional effects, e.g., from integration, but also from the reduction in unit costs [20]. A good solution can consist of calculating, for each municipality, the difference between the expenditure (costs) for the operational work and the ticket revenue. However, a given municipality shall have the opportunity to affect the amount of operational work and the level of service, and in turn the amount of contributed financing. This is not always possible; for example, in

a situation where there is a high share of intermunicipal lines and decisions about changes to operational work, arrangements with a few municipalities are necessary (on this matter, there are frequently differing opinions related to timetable changes). Methods assuming averaging (the same subsidy per resident, per vehicle-kilometre) are not good, because they result in demands to increase the transport offer in such places, where this is unjustified. At the same time, the municipality pays the subsidy at an average amount, while, due to small demand, the line requires a higher subsidy. In this situation, contributions to the subsidy are made by other municipalities in the form of an increased average subsidy to urban public transport in the area of a supramunicipal structure operation. Hence, in this case, no solution stimulating effectiveness in relation to the common organization of public transport is obtained. Urban public transport is financed from public funds. However, this does not mean simplifications in settlements nor assumes that this service is to be provided in a way where there is no identification of subsidies to lines, to places of their origination, municipalities or to certain social groups, e.g., people who enjoy concessions and free travel. Concerning funds, which are spent on the community in a specific municipality, it is necessary to adopt a settlement model with costs and benefits from the given municipality perspective.

Public financing is an additional challenge when seeking solutions aimed at the effective provision of such goods. Subsidy identification, broken down into lines and municipalities, enables making decisions about the transport offer size and also allows for the place of subsidies to be identified. In turn, this reduces the mechanism of transferring the burden of subsidies between municipalities, which is favourable for the application of the 'user pays' rule. This rule refers not only to passengers, but also to municipalities, which define the transport offer size in their area.

Pursuing the determination of rules for municipality participation in financing the operation of a supramunicipal public transport organizer, as well as the division of deficit originating out of the comparison of tariff revenues and costs, it is most frequently possible to encounter the pursuit of solutions accepted by participants, which have just features. This requires criteria to be determined and adopted, while divisions should later on be made in accordance with the adopted criteria. The issues related to justness in the allocation of goods, rights, burdens and costs over many years have been the subject of immense consideration. Even in *primaeval* communities, there were rules of distribution, e.g., the division of meat from the hunted animal. Occupied territories, wealth acquired collectively, legacies, benefits resulting from common business projects, the number of mandates in collegial authorities at various levels and the allocation of votes to political parties in elections were all subject to division. Most often, division refers to goods allocation, but this is not limited to costs or burdens, because their reduction is also certain good [3,7,10,11,12].

Equality, justice and poverty occupy an important place in the considerations of two Nobel Prize winners in the field of economy, i.e., Joseph Stiglitz [13,14] and Amartya Sen. In particular, Amartya Sen represents a rare trend in the humanistic economics by referring to ethical, political and strictly economic argumentation. He considers the social foundations of prosperity, and in particular to what extent the economic system provides equal life opportunities to participants [2].

Justice and just distributions are applied to an increasingly great extent, and not only on a macro scale, but also in the context of numerous current matters occurring at regional and local levels, in local governments or economic operators themselves, as well as in various types of communities. This is partly related to the increase in the scope of tasks performed by the public sector, hence to the amount of gathered funds, with regard to which the principles of their distribution and goals, on which they are spent, are not decided by consumers, but by

various representative bodies. In addition, disproportions and inequalities grow on various scales, in terms of individual wealth and poverty, economic operators' resources, individual regions and states. Globalization and the ease of movement and communication reveal those differences, as well as questions including about the principles of manufactured goods distribution and the scope of aid between states or other entities.

In the practice of public transport management on a regional and local level, justice theory issues become important in solutions related to the common performance of tasks, for example, common transport organizations and common tariff-ticket solutions. The adoption of a settlement model based on stable and widely accepted foundations ensures the durability of those solutions, which is very important. IT systems, allowing many data to be acquired for settlements, do not necessarily resolve the problem, because frequently a wider perspective is expected, along with the elimination of existing differences.

3. THEORIES OF JUST DISTRIBUTION

It should be noticed that justice is a more philosophical and social notion, and not strictly economic or even mathematical. Thus, historical and social processes decide what is just or not, and not exclusively objective truth. Science can only help here, rather than resolve this issue [9]. It is assumed that, when something is unjust, society does not accept it as a matter of principle. From this point of view, the notion of justice, including with regard to division relations, has been historically evolving. Things that, in the past, were considered just are today treated as expressions of injustice. Meanwhile, what contemporary communities are prone to consider as comprising acceptable standards of justice would have entirely rejected by society in the past [9].

There are many theories of so-called just distribution, which are founded on various assumptions and expectations. For the needs of this study, three general theories of justice can be indicated, the oldest and best known being that of Aristotle, according to which goods should be divided proportionally to each individual's contribution. Although this idea can seem convincing, it has two significant limitations. Firstly, it is necessary to have a method to measure each individual's contribution on a cardinal measurable scale. Sometimes, the indication of such a measure does not present difficulties, for instance, it could be concerned with the time of work devoted by individual employees to perform a common task. In other situations, the measure of contribution is not that clear. Secondly, to be capable of applying the proportionality rule, the goods must be divisible. If they are not, they can be made divisible, distributing opportunities of receiving the specific good, but then the rule is no longer convincing [17].

The second theory of justice is classical utilitarianism, according to which goods shall be distributed in such a way as to maximize the general level of well-being among interested persons entitled to a specific benefit (the greatest good for the largest number of people). To give a sense to this notion, the utility must be treated as a measure of satisfaction or of feeling well, which can be assessed on a cardinal measurable scale, and values for individuals can be summed up [17].

The third approach is based on the central distributive principle, known as the principle of maximin or difference, which can be formulated as follows: the worst-off group in society shall do as well as possible [17]. Thus, this requires us to look at who is doing worse as a result of distribution (e.g., incurs the greatest burdens or gains the least).

Difficulties related to the second and third principles have encouraged some economists to adopt an entirely different approach to distributive justice. In particular, we can refer to the absence of envy [17]. A specific distribution is referred to as not increasing envy if nobody covets someone's other share more than their own. This is applied during distribution cases, e.g., according to the rule, 'I distribute, you choose'.

The allocation rules encountered in practice usually refer to one of three main ideas of justice [17]:

- Equality of rights - this means that individuals shall be treated equally, either because they are indeed equal or because there are no clear criteria allowing inter alia to differentiate between them.
- Proportionality - this means that differences between individuals are recognized and a specific good is divided pro rata according to those differences.
- Priority - this means that a specific good shall be received by the person who is most entitled to it.

Various distribution principles are presented and no single theory have been developed in order to resolve various issues in goods allocation. Furthermore, none of the presented principles has a universal application or leads to unambiguous results. However, the very reduction of the problem to a few principles and the indication of their limitations and application possibilities give signals and guidelines concerning situations in which they should be used. In addition, attention should be drawn to the fact that the basic principles of justice can turn out to be useless in situations in which alternative costs can determine the number of individual shares, that is, costs that would be incurred if a given problem is resolved independently. It is also necessary to be aware that, despite the problem's origins in antiquity, this is a new research area, which is interdisciplinary and part of a changing reference system, in which numerous issues are not clearly defined.

In the field of financing the activity of supramunicipal public transport organizers, there are various opinions, which can also be key factors when deciding on the establishment of a given entity or concluding an agreement. Hence, the application of various measures for settlements was analysed [6]. However, the influence on organizational effectiveness does not come down to the formulation of financing principles. Growing GDP, increasing demand and expectations for public services and increasing importance of urban public transport as a factor reducing external costs, in particular, in the field of resources and city environment protection, can result in the reduced importance of settlement procedures. The adopted principle of financing derives from city policy in the field of public transport as well. It is possible to notice that this problem grows out of the situation of limiting market decisions, in favour of transferring them to the public administration. This highlights the importance of an economic element, whereby it is expected that this rule will compel urban transport to be effective, as well as ensure the element of justice, in that it will at least not be openly unjust, so that participants in an intermunicipal union will accept it.

4. CRITERIA FOR MUNICIPALITIES' PARTICIPATION IN COMMON PROJECTS AND DEFICIT DIVISION

The adopted measures, according to which the subsidy is calculated, are not necessarily directly connected with cost carriers in individual municipalities. In the case of public tasks, the number of residents is frequently the basic reference. In many situations, it is possible to

encounter the adoption of this criterion, which ensures a uniform subsidy calculated per resident, but the missing relationship with the costs is the problem. In the case of this missing relationship, there could be a situation where the municipality expects the offer to be improved, in terms of quantity and quality of services provided in its area, which does not affect the amount of funds assigned by the municipality to urban public transport financing. The level of subsidies required from municipalities is also important. The increase in service amounts is related to a growth in the total subsidy amount (the amount of operational work increases, the number of vehicle-kilometres), as well as to a greater subsidy converted into a unit of operational work.

The criterion of municipality revenues is another element; as a result, municipalities with higher revenues pay more. Such an approach can be justified by the argumentation used for progressive tax scales in the case of corporate or personal income tax. An easier absorption of liabilities is the argumentation here. The justification of the progression rule is simple: those who have a higher income should pay higher tax, because they find it easier to absorb the incurred expenditure [17]. A traditional justification of progressive taxation is its role in equalizing differences in income and well-being, side effects of market system functioning. In accordance with this justification, progressive income tax is a corrective mechanism needed by society to reduce inequalities. Whether the above argument is convincing or not depends obviously on the extent to which the tax system actually contributes to a reduction in inequalities [17]. However, in the case of supramunicipal organizers, the application of such a rule is doubtful, because it results in crossflows of funds. But cities frequently emphasize the need for municipal solidarity and the common financing of projects.

When common projects are implemented by cities in the field of public transport, it is difficult to assume an equal division of costs. Although partners are separate entities, in practice, they are equal partners albeit only as legal entities. But, most often, they differ in many respects: various opportunities resulting from possessed natural resources or entities situated, the number of residents, revenues. Hence, in the case of the equal division of costs between partners, the division between cities of various populations means that the burdens per resident can be very much diversified. Thus, it is possible to equally assume per resident or be willing to consider diverse saturation with the transport offer, while, at the same time, relate the settlement with costs, which are equally converted into units of operational work (e.g., vehicle-kilometres). Unfortunately, the cost division according to the number of residents or to the number of vehicle-kilometres does not consider alternative costs; hence, the situation when cities should provide a service on their own. The division principles should be, as much as possible just; but, in the case of common projects, they should motivate participants to cooperate. In such a situation, it is also necessary to focus on how much individual parties would save by participating in a common project. If each of them was to compare the cost of independent task performance with the cost when the task is carried out together and savings are visible, only then will it be possible to talk about the motivation for cooperation.

However, it is necessary to assume that any of the municipalities participating in a supramunicipal institution, which is organizing public transport, would not pay more if it were to perform the task on its own. The amount spent on independent organization could be assumed as the maximum level of financing. Organizing public transport together, apart from benefits related to integration (common ticketing, transport offer coordination), also results in economies of scale as well as the benefit of market selection for service providers. This results in the reduction of unit costs related to transport service provision, but also of other services, including transport organization. At the same time, there could be situations where

principles of intermunicipal entity operational financing do not consider differences related to urban public transport in municipalities. This could be related to:

- equal importance of common lines in the area of individual municipalities
- location in the municipality area of an urban public transport depot, which increases the amount of operational work (however, benefits related to jobs and to the entity location should be considered)
- expectation of service provision primarily from the given municipality residents' point of view

The common satisfaction of residents' needs should be cheaper than if this task is implemented independently. In addition, broader issues should be considered here, apart from the cost element, which are understood as own costs, because transport generates significant external effects, especially in cities. Moreover, an independent organization set up by cities constituting a conurbation, where residents travel between those cities, is practically unrealistic due to substantial nuisance (e.g., various tickets).

In the case of an independent organization providing urban public transport, cities, irrespective of the adopted subsidy carrier, subsidize the difference between revenue from tickets and costs. So, in the case of a common organization for urban public transport, this direction of settlements should be determined, e.g., in the form of an intermunicipal union or agreement. Benefits of a common public transport organization are achieved, but, at the same time, the fact that, with an independent organization, the cost/subsidy amount will not be lower, is considered. Each of the parties achieves measurable financial benefits resulting from the developed cooperation.

Attention should also be paid to the intrinsic nature of dynamics in the field of methods for settlements between municipalities. This results from the changing approach, over time, to public tasks and principles of their financing, but also from the development of instruments enabling the measurement of quantities, which, even a dozen or so years ago, were difficult to measure. These instruments are IT systems, enabling, on a massive scale, the automatic acquisition and processing of a lot of information related both to the transport offer and to the transport behaviour of residents. The development of systems for passenger flow measurements, vehicle location and fare collection systems based on electronic cards allows for learning the places for deficit origination and referring them to residents, transport entities and to specific spatial locations.

5. MEASUREMENT OF QUANTITIES ADOPTED FOR SETTLEMENTS

An important issue consists of measuring the revenue for public transport lines, in particular, the operational work performed on them and the obtained ticket revenues. The measurement of costs, when the operators are paid for a unit of operational work, does not raise any issues. They are directly available from the accounting records, which cover the amount of specific entity expenditures.

The widespread application of electronics and IT provides possibilities to measure the revenue, based on the automatic identification of the number of persons getting on and off or using fare collection systems utilizing electronic cards [15,18]. However, it is necessary to consider the mass nature of urban public transport and the transport offer changing at a significant pace, which in the case of big systems will result in a situation where the data will not always be complete. Moreover, it will not always be possible to include all transported

passengers in e-card systems. Some people are entitled to free travel, including those who can travel in an unauthorized way, beyond the recording systems. Settlements in the field of fare collection or counting persons using urban public transport cannot make the use of such a service more difficult. It is also necessary to create possibilities to join the system via new entities (transitional periods, a new carrier, adapting to the standard), while systems that are less advanced in terms of technology should be considered. Therefore, especially in the case of big urban transport systems, it is necessary to develop models to estimate the data and forecast the basic quantities as well as settlement models related to common ticket sales.

It is necessary to emphasize that the settlement system can apply to various ticket types, both single journeys and season tickets. In the case of season tickets, there is some repeatability between completed journeys and longer single-travel tickets, which need to consider entitlements to travel by all or by partial means of transport offered by entities participating in the common ticket system. In practice, this means easier recording of a larger scope of data characterizing the mode of travel based on season tickets (in particular, monthly tickets or for longer periods of time).

Modern fare collection systems by means of e-cards, which use chip (smart) cards, allow data to be acquired about journeys and collected fares for public transport services' use. They can be applied to the transport offer planning processes and also settlements related to the public financing of public transport, as well as identifying the amount of lost revenue resulting from the application of entitlements in terms of concessions and free travel. Significant possibilities of electronic cards result from a high capacity of data storage, data processing capability, robust protection, complicated algorithms enabling good encryption of transactions, the possibility to enter data again and usage in multiparty services. Contactless cards are used for communication with external systems in public transport, which only require them to be hovered over the reader to facilitate rapid processing. They are also more convenient and durable and the entire system is cheaper to operate than in the case of contact cards. E-cards feature a high resistance to external disturbance and a high durability of the record and of the cards themselves.

The introduction of fare collection systems based on electronic cards provides the possibility to acquire, in digital form, the data related to service use: it is easier to process the data and use them to control the equipment, e.g., entries to transfer point areas.

The degree of IT deployment difficulty in urban public transport depends on the solution scale. For small systems in urban public transport, there are no major problems with the implementation of solutions in the field of automatic recording revenue amounts for individual lines or their sections. The fact that the implementation cases of fare charging, based on e-cards in entry-exit or only-entry identification systems, in Poland most frequently in small and medium cities could be an example. The project becomes more and more costly and complicated with increasing city size, the number of operators and the diversification of public transport reach and the transport offer [16,19]. Possibilities offered by IT permanently grow, which results from information science development in terms of hardware and software, as well as data transmission.

Looking at deployment cases in Poland so far, it is possible to state that they do not always fully utilize possibilities created by e-card technology. In particular, this applies to the price differentiation, while, in many cases, the number of journeys is not identified, as well as the distances covered or the performed operational work. E-cards are also frequently used to only pay for urban public transport services. In the case of solutions enabling payments for other services, frequently, this is not carried out from a common pool of funds on the card; rather, this requires separate prior purchasing of those services. Situations where full

functionality of fare collection systems using e-cards has not been achieved most often do not result from technological conditions, but on account of organizational, legal or economic reasons. The use of one e-card on public transport systems, involving many entities with various tariff regulations, requires relevant institutional solutions or the use of bank services for settlement of funds.

6. CONCLUSIONS

The universality of public financing for urban public transport, as well as the provision of services on lines whose routes go beyond administrative areas of cities, requires systems to be set up for centralized financing. This applies primarily to current public financing, where the obtained revenue from ticket sales is lower than the expenditure for the operational work. Financing systems can apply to other assets, while the institutions organizing urban public transport are or can be owners of transport companies or the infrastructure related to public transport. Thus, the settlement issues apply to both divisible and non-divisible elements. The importance of financing principles to urban public transport results from significant funds allocated to this task for financing and from possibilities to use public financing as a tool affecting the amount and spatial location of the transport offer of urban public transport. The relationship (subsidy amounts and rules vs. public transport services prices) is crucial. In terms of urban public transport prices, it is possible to influence the scale of demand for services, while cities frequently implement elements of social policy in this way. This situation is made more difficult via a possibility of fund crossflows and as a result of transferring a part of the costs between municipalities, thus creating a specific supramunicipal structure or participating in an agreement.

Principles, according to which public transport is financed from public funds, have a critical impact on the rationality of fund spending. The connection between financial results obtained on individual lines and within a municipality with the amount of public financing provided by the municipality results in a pressure that matches the transport offer to residents and the financial capacities of the municipality. However, in the case of a large share of intermunicipal lines, diversified financial capacities of municipalities and various roles played by urban public transport in municipality operation strategies, there are difficulties with the offer optimization from individual municipalities' point of view. This means that the element of obtained financial results should not necessarily be the only criterion on which the amount of subsidy depends. Attention should also be drawn to the fact that public transport is significant for the spatial development of cities, as it stimulates the development location and activation of city areas. Hence, the current financial results for transport lines and routes cannot be the only criterion for decisions related, e.g., to the line and hence infrastructure liquidation, as is the case for tram transportation.

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Received 25.04.2018; accepted in revised form 28.08.2018



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