Torun International Studies

2022, No. 1 (15), pp. 93–112

Published online June, 2022

DOI: http://dx.doi.org/10.12775/TIS.2022.006

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PUBLIC AID AS AN EFFICIENT TOOL FOR DEVELOPING THE RAIL SECTOR IN EU MEMBER STATES

ABSTRACT

Rail transport is paramount for the functioning of a sustainable and efficient transport system. EU policy identifying significant role of rail translates into a strong financial support allocated to the transport sector both in the form of services funding and of infrastructure investments. In the study conducted, the impact of public support for rail transport was analyzed in reference to several indicators describing the condition of that sector. The analysis covered an assessment of the impact of public support granted based on PSO – Public Service Obligation, and of the support for infrastructure investments. The results reveal a great variability of the outcome across countries. Countries which provide stronger support for infrastructure investments are characterized, as a rule, by better performance. In the Authors' opinion, strengthening the support for infrastructure investments at the expense of support granted as part of PSO should be the path for rail funding policy redefinition.

Keywords: public service obligation, railways, state aid, efficiency

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1. INTRODUCTION

The impact of transport on the economy has been analyzed on multiple occasions and though it is possible to indicate research demonstrating both positive and negative impact of transport investment on the economy (Hoyle, 1973, Bhatta, 2003), it is beyond any doubt that transport network is necessary for the economy to function (Banister, 2012). At the same time, the issue of state involvement in the rail market is of special interest, considering the predominant operating models for that sector existing worldwide. In the contemporary transport system, which has emerged because of the post-war development of road transport and aviation, the rail sector is undergoing changes as it attempts to regain the areas it has once lost.

Increase of the external costs of social mobility (e.g., noise and accidents – Mayeres 1996) along with emerging identification of climate change challenges where transport is a significant emitter (according to European Environment Agency data, in 1990 transport sector was responsible for 21% of green-house gases emission in EU) called for sustainable transportation. At the dawn of the 20th century, the railway sector became an important part of EU policy for transport sector. The first mentions of the need to increase the importance of rail transport can be found in the Communication from the Commission 'The Future Development of the Common Transport Policy: A Global Approach to the Construction of a Community Framework for Sustainable Mobility' of 1992 (COM(92) 494 final). It was pointed out that the development of the common transport policy must respond to the environmental challenges and to the effects of exploitation of natural resources. This idea was elaborated in the following documents by the Commission – White Paper 'European Transport Policy for 2010: Time to Decide' of 2001 (COM(2001)370 final) referred to the rail sector as a strategic one in the transport system. Such a direction of EU transport policy development was further expanded in White Paper 'Roadmap to a Single European Transport Area – Towards a Competitive and Resource Efficient Transport System' of 2011 (COM(2011)144 final). The identification of such direction of transport system development as desirable also occurred at the national level. It translated into the level of subsidies for the rail sector, which were already used in particular EU member states before introduction of European policy in this respect, although with its introduction they become more important as a part of common policy. According to the State Aid Scoreboard 2019 developed by the European Commission, railway sector subsidies totaled EUR 50 billion in all the EU Member States in 2018. Intensity of state support may vary among transportation sectors although as De Borger and Proost (2015) observe "almost all public transport activities are heavily subsidized by the government".

Having regard to the level of expenditure on support for the rail sector and to the attempts to implement the transport policy objectives by increasing the share of rail in the EU transport, it is legitimate to analyze the efficiency of spending in that area. The research conducted aims to ascertain the effects of funding rail infrastructure and transport services and to indicate the more efficient of the two forms of support for this sector. The research problem presented in the article focuses on analyzing the impact of public spending dedicated to respective spheres of influence on the functioning of rail sector in each EU country. The purpose of the article is to determine the extent to which public aid earmarked to Public Service Obligation (PSO) services in European Union Member States can have a real impact on the change in the strategic rail sector indicators as the rail transport sector is a significant public

aid beneficiary. The aid is earmarked especially for infrastructure and PSO services. This will probably not change in the future, considering the EU social and environmental policy. The ongoing liberalization of the rail transport sector requires, however, a greater control over the public spending efficiency (Woll and Meaney, 2017, p. 639). For purposes of following discussion and in line with the research goals, PSO is defined along with EU legislation in this respect. According to the EU law, state aid is considered as "any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favoring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States" – which will be discussed in more detail in the following sections.

The Authors wish to examine whether and, if so, to what extent the measures taken by the authorities in respective EU countries in terms of spending on PSO, on the one hand, and direct rail investments, on the other, affect the rail sector indicators. As the sole PSO, or more public transport, state aid schemes introduced in particular countries have a significant impact on efficiency of public spending, in this paper the impact of PSO versus investments in railway sector is analyzed regardless of the PSO scheme. Such approach has been decided to verify what kind of state support for railway sector in EU countries has more significant impact on the sector performance rather than to discuss advantages or disadvantages of particular PSO models. The results indicate countries where PSO schemes may be adjusted to increase efficiency as well as countries where infrastructure investments still ensure more positive impact and as such are required to further increase of the railways role in the transport system.

A mixed methodology combining the results of qualitative and quantitative research is used to empirically verify the hypotheses related to the presented research problem. The qualitative research is based on descriptive analysis, and the quantitative research includes the method of statistical information systemization, based on statistical source data analysis, and static dependence methodology, including fixed effects and random effects panel models.

2. ORIGIN, SCOPE, AND SCALE OF THE STATE'S INFLUENCE IN THE RAIL SECTOR

2. 1. TRANSPORT AS A SIGNIFICANT ELEMENT OF THE SOCIAL AND ECONOMIC DEVELOPMENT

The consensus on treating transport as paramount for the society and economy has been reached at national policy levels and is reflected, among other things, by the public spending allocated to this sector. According to Eurostat data, the average public funding for transport in EU in 2018 stood at 2% of GDP. The level of expenditure is stable and in the period from 2001 to 2018 it ranged from -0.2 pp to +0.3 pp. At the same time, it varies significantly across countries, reaching 0.7% of GDP in Cyprus and 4.4% of GDP in Hungary in 2018. In the above-mentioned statistical category, in line with the COFOG methodology, it includes public spending taking special account of the use, construction and maintenance of transport systems in the following sectors: road, water (inland navigation and maritime transport), rail, aviation and pipeline. As defined in Eurostat Manual for COFOG total expenditure of General Government in terms of transport covers, e.g., subsidies or renumerations

incurred or transferred during the main activities mentioned above – construction, operation and maintenance. In 2018, according to Eurostat, public spending on transport in EU countries ranked 5th on average (out of 69) among COFOG subcategories, outweighed only by spending related to pension and health insurance.

The global increase in transport demand has led to a growing pressure on the natural environment and the quality of life, especially in urban and industrial areas (e.g., Chapman, 2007; Cahill, 2010; Hoen, Tan, Fransoo, van Houtum, 2014). One of the responses to the emerging challenges was to identify the key role of rail in aiming to create an efficient and sustainable transport system. The rail sector may be seen as sustainable when compared to other used means of transport from diverse perspectives. By way of example, Schroten et. al. (2009) presents the calculation of external costs of respective means of transport, taking into account, among other things, costs of accidents, air pollution and the noise generated. For passenger rail transport, the cost of passenger-kilometer (p-km) amounted to 1.3 eurocent for high-speed rail and 2.6 eurocents for electrified conventional rail compared to 3.4 eurocents in air transport and 12 eurocents in road transport. In freight transport, the difference was 3.1 eurocents – 1.1 eurocent in rail transport and 4.2 eurocents in road transport. In terms of energy efficiency, rail transport is also the least energy-intensive means of transport. Lipscy and Schipper (2013), and Pomykała (2018) demonstrated a significantly lower energy consumption per p-km in rail sector than in road or air transport. Regarding emissions of particular transport sector, the above-mentioned study of Pomykała (2018) estimates CO_2 emission for cars between 0,13 and 0,09 kg CO_2/pkm and for railways from 0,02 to 0,01 kg CO_2/pkm. Wee *et. al.* (2005) estimates that average emissions of CO_2 and NO_x in freight transport in the Netherlands in 1995 for cars was respectively 123 and 1,4 g/tonne-km and for electric trains 44 and 0,05 g/tonne-km. According to European Environment Agency, road transport is responsible for 73,1% of greenhouse emissions in EU while railways for only 0,5%. Based on the above studies, railways should be considered as the most efficient (mainly in terms of energy consumption) and sustainable (mainly due to low emissions) inland transportation mode both in passenger and freight traffic.

The increase of transport pressure on environment has been reinforced by rapid escalation of transport demand. In 1970, 310 million passengers were carried by air while in 2005 the figure reached nearly 2 billion (based on UN data), strengthening the role of air transport as the key means of transport in long-distance passenger traffic and a significant one in regional and national travels. At the same time (according to Eurostat data), in the regional and national travel sector, individual transport means gained and strengthened a major role – for example, in 27 EU countries, the number of cars per 1000 residents increased from 289 in 1990 to 438 in 2005. The increase in the number of cars resulted in higher share of road transport in total land travel, which stood at 77% on average in 1995 and in 2005 it exceeded 80% of total p-km in EU. Despite its advantage of sustainability, rail must compete against air transport in the passenger sector and against the efficient maritime transport in the freight sector, while contending against the flexible and cost-competitive road transport in both those sectors.

Before moving further to the discussion on importance of railway infrastructure and relevant investments in this area, the impact of transport in widest term needs to be addressed. Hoyle (1973) formulated thesis that studies on transport and development "[…] may be explained by difference in two main factors: (1) the creation of economic opportunity and (2)

the response to economic opportunity". Nor him or other researchers argued with concept of importance of transport for economy. Bhatta and Drennan (2003) identified 40 studies between 1989 and 1999 regarding impact of transportation infrastructure on economic development. Various results from conducted studies differ in identified impact. In the last decade, one of the most common theory states that transport network is necessary for functioning of the economy although above some threshold further infrastructure investments has less impact (Banister, 2012). It is "generally recognized among social scientists and development planners that transport has and will continue to play a critical role in development" (Leinbach, 1995). Leinbach described transport in relation to the development as "necessary but not sufficient". No studies undermine acknowledging the necessity of transportation for development and economy. Researchers do not discuss in this respect the existence of such impact but rather its strength. The indispensability of transport for economy, regardless of whether we will identify transport as a facultative factor or a casual one in respect to economic benefits (Melia, 2018), is a general consensus among researchers.

The efficiency of state aid has been also analyzed on numerous occasions. From a global perspective – analyzing the impact of public infrastructure investments – the average positive efficiency of the public capital stood at 0.2, so "a 10 per cent increase in public capital stock increases GDP by around 2 per cent" according to research carried out by Eddington (2006). Admittedly, some studies provided a lower value for this effect (Dienemann, Lago, 1971; Kocherlakota and Yi, 1997; Demetriades and Mamuneas, 2001; O'Fallon, 2003; Nijkamp and Poot, 2004), however, as pointed out in a OECD report of 2003, the impact of public investment on the economic growth is generally identified, though it is difficult to determine its detailed level. Detailed research into the impact of transport on the EU economy was conducted by Gherghine et al. (2018). The results indicated a positive impact of transport infrastructure (especially the rail infrastructure) on GDP per capita in EU Member States and a positive impact of infrastructure investments on the economic growth. Saboori et al. (2014), conducting analyses based on earlier research in that area, concluded that "the transport sector represents a necessary economic growth factor, ensuring an efficient distribution of goods and mobility of the population". At the same time, it also needs to be noted that some research shows insignificant or mixed results of public investment on productivity and growth (Ford and Poret, 1991). Also, some research argues that the importance of infrastructure on economic development has been overemphasised (Tylor-Lewis, 1993). Regardless of such individual studies opposite to research arguing on positive impact of investments, it should be emphasized that a body of knowledge strongly supports theorems on the importance of infrastructure – including the transport infrastructure – for economic development. Even if infrastructure investments in some studies do not provide direct added value for economic development, the efficient, sustainable, and accessible infrastructure is considered as a vital and essential condition for performance of economy.

2.2 STATE ROLE IN THE RAIL SECTOR

Thompson (2003) proposed a matrix of rail system models worldwide, differentiated in terms of private capital involvement and organization structure. In terms of ownership, he distinguishes public, mixed (concessions and franchises) and private structures. At the same time, as regards the sector's structure with reference to infrastructure and organization of transport, he makes a distinction between integrated models, highly integrated models with

separate smaller operators and split models. Integration may be identified both vertically (as integration of railway undertakings and operators) as well as horizontally. Each of the 9 models proposed in this matrix can be easily identified in respective countries of the world. In the EU, when it comes to structure, unbundled model is in use, which stems, among other things, from the EU transport policy goals and outcomes, which aim to separate infrastructure administrators from carriers. When it comes to the ownership differences, the specific case of UK railway system needs to be noted. The UK decided to introduce private ownership within its system to a high extent between 1994 and 1997. Since then, PSO contracts have been awarded to private operators under a franchise mechanism. Although we can observe significant changes in the UK rail sector in 21st century, starting from nationalization of infrastructure to withdrawn from franchising system announced in 2020, the system itself is still shaped in a different manner than in EU countries. The overall review of those differences is provided in Williams Rail Review (2019), although for this study most important observation is that "UK's transition to the private sector operation of trains in the 1990s was very rapid. Other countries have taken a more gradual approach, with this transition continuing today as EU legislation evolves". Regardless of some differences between the continental EU and the UK measures, EU policy moves by the consistent path of increasing demonopolization of the rail transport market. Relevant rules are introduced in so called railway packages, i.e., legislative acts relating to the rail sector. These began with the 1st railway package adopted in 2001 and implementing three directives, the latest one being the 4th package adopted in 2016 and currently coming into effect, which includes six legislative acts organized around so-called technical and market pillars. The solutions introduced over the years have enforced the unbundling between carriers and infrastructure administrators and go towards increasing the competition between carriers. According to the Commission's analyses (6th Rail Market Monitoring Report), more than 60% of rail transport services (p-km) in 2016 in the EU were provided pursuant to PSO – Public Service Obligation. At the same time, as pointed out by the Commission, only 41% of PSO services were contracted as part of a competitive tendering procedure although studies indicate a competitive model in a railway sector as more beneficial, e.g., for passengers as the ticket price tends to decline (Virgen, 2017). This means that despite the legislative measures at the EU level, a major part of the rail market is shaped by the unchanging predominance of incumbent public carriers managed at the national and regional level. Similar conclusions are revealed by Ludvigsen and Osland (2009) study on the degree of market liberalization in rail freight transport services in the EU in reference to the 1st railway package of 2001. The authors note substantial differences in the implementation of market liberalization regulations, citing Norway, Sweden, and Finland as countries where the regulations introduced in the railway package have been fully implemented, and Poland, Hungary, Czech Republic, Austria, Romania and Greece as those where only a part of regulations has been implemented, with incumbent carriers still having a dominant position. Similar conclusions were presented by Maurer et al. (2010), pointing to the existing market entry barriers for passenger carriers. As observed by Esposito et al. (2020), rail market liberalization contributes to an increasing share of this transport sector in total transport services. On the other hand, Tomeš (2017) points out that the direction of transport policy reforms set by the EU and consisting in vertical separation and market opening does not have a significant impact on the share of rail in the sector breakdown.

Along with the heterogenous degree of state involvement in railway operations under PSO in particular countries, a dominant role of a state in a railway infrastructure needs to be underlined. Policies on the EU and national level indicating railway transport as crucial for creation of sustainable transport system are reflected, e.g., in funding allocated in railway infrastructure investments – during the 2005–2015 period the amount allocated in railway infrastructure investments in EU member states was about 45 billion EUR yearly.

Many studies discuss an impact of railway infrastructure on economy. For example, Wang and Wu (2015) analyzing Quinzang Railway in that respect. In their study the authors have shown a significant stimulation effect on the economy of counties with a railway line passing through. "The local GDP per capita increased by about 33% after the railway had begun to operate". Other example of research in this area is Kim's (2017) study on impact of railways on local economies finding that railways had impact on 19th century growth of market-oriented agriculture and increase of productivity in a manufacturing sector. Hallas (1986) examining an impact of railway in Wales on development of traditional and new industry in the 19th–20th centuries argues that "the railway laid foundations for the modern tourist industry, assisted agriculture to adapt to changed circumstances and markets thereby enabling it to survive periods of depression […]".

A significant area of research in this respect concerns specific segment of the railway sector – high speed rail. According to the Worldwide Railway Organization (Union Internationale des Chemins de fer – UIC) definition, railways can be considered as high speed when a commercial speed exceeds 250 km/h. In the last decade, an unpreceded development of high-speed railways can be observed in China as over 25 000 kilometers of dedicated high-speed railway lines have been opened since 2008. Also, one of the highly developed HSR system is in Japan, where a length of the lines reaches 2 700 km. Due to the above, numerous studies in this field have been conducted on those economies. Zhang et. al. (2014) analyzed influence of HSR on regional economic development and argued that high speed rail promoted a regional industrialization process. Yang et. al. (2019) examined an impact of HSR on enterprise productivity. Results showed a positive effect of HSR on enterprise productivity in core cities (1,38% growth), yet a strong negative impact in peripheral cities (8,45% decline). The role of HSR in changing industrial dynamics in Chinese regions has been examined by Zhu et. al. (2019), where authors argue that high accessibility of HSR network stimulates new industry creation and enhances regions diversity regarding industry.

Considering impact of HSR, a limited usage of PSO schemes on the HSR network needs to be noted. In most countries, HS networks or lines are considered as commercial services not applicable for PSO support. There is often strong competition between private and state-owned operators. At the same time, conventional lines require high PSO support in order to ensure accessibility to sustainable transport modes on long distance regional, urban and suburban routes. Regardless of different requirements and rules for, e.g., long-distance and suburban railway transport, for the following discussion PSO has been analyzed in a general scope, without distinction on particular type of services. Such approach has been decided in order to allow horizontal analysis of PSO efficiency in particular countries, while a more detailed depiction and research in this area would result in a significantly longer discussion.

2.3. STATE AID AS EXEMPLIFIED BY RAIL SECTOR

As it has been already depicted, the state aid is an important factor affecting the rail sector. Though the literature on state aid is generally extensive, the issue of public funding of rail transport is often limited to particular, reduplicated countries rather than presented in a wider context. Such discussion on PSO schemes is still ongoing, although it is beyond the scope or goal of this paper focusing on more horizontal and general point of view. Usually, this issue is addressed when discussing overall regulations on state aid (Bacon, 2017; Ianus, Rusche, Orzan, 2016; Colucci, 2008; Scharf, 2016), in one of the chapters dealing with detailed aid allocations. All these publications discuss state aid regulations relating to rail transport sector and the attitude of the EU legislator to the public funding of this transport branch. One of the most interesting publications of this kind is the one by Woll and Meaney *Transport Aid* (Woll & Meaney 2017). The Authors address in detail the issue of state aid in rail transport. They focus not only on the content of the binding EU legislation in this domain, but they also explain which types of support apply in practice and what is their impact on the rail transport market competition.

The concept of state aid was defined in the Treaty on the Functioning of the European Union. The definition is of significance from the perspective of assessing the economic efficiency of granting public support in the rail transport sector. Pursuant to Article 107 (1) of the Treaty, state aid is "any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favoring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States". This provision bans any support that meets the above criteria. Whether public funding represents state aid or not is mostly determined by whether it can affect market and competition.

The objective of the EU state aid regulations is to build and enable the functioning of a single internal market and to protect competition as the fundamental mechanism governing the redistribution of goods on this market (Bacon, 2017, p. 4; Nicolaides, Kekelekis, Buyskeys, 2005, p. 1). Relying on the insights of T. Kleiner (Kleiner, 2011, p. 2), it can be pointed out that in rail transport, such regulations are mostly aimed to prevent a situation where opening up national markets and removing barriers protecting them will not result in development genuine competition. It is possible that some countries will introduce a support system for transport operators, the effect of which will be the same as the effect of the removed barriers (abolished protectionist mechanisms). It should be underlined that public support is liable to distort competition even if it does not help the recipient undertaking to expand and gain market share. It is enough that the aid allows it to maintain a stronger competitive position than it would have had if the aid had not been provided. Such support would help domestic operators offer their services at lower prices – which would result in them having an easier market entry in other Member States, on the one hand, and in companies from other countries having it more difficult to enter a market where entities benefiting from support are operating, on the other hand. In such case, the opening of domestic markets and the abolishing of barriers that protect them, as enforced by the EU transport policy, would not yield the desired results. To some extent the actions preserving the state's dominant role in railway operations may be introduced to avoid decrease of services on low benefit lines as private operators may limit their services only to most profitable routes. Such

situation would hinder development of the sector so it needs to be addressed by maintaining strong PSO scheme to ensure services on an entire network.

State aid regulations must ensure balance between the competition protection and the proper functioning of a social market economy (Jaeger, 2016, p. vii). That is why the ban on state aid, laid down in Article 107 (1) of the Treaty, is not absolute in nature and there are many derogations from it, set out in Article 107 (2) and (3), Article 93 and Article 106 of the Treaty, including those specifically dedicated to the transport sector. It can be generally said that these derogations apply, and state aid is considered to be compatible with the EU's internal market, and thus acceptable, where the need to pursue other values identified by the law outweighs any threats to the competition.

Hence, public funding of the rail transport sector can be divided into funding that does not meet the Treaty's definition of state aid, and funding that represents state aid but is compatible with the principles of the EU's internal market and thus acceptable. In the former case, public funding has no impact on the competition on the rail transport market. In the latter case, though support is considered acceptable, it exerts a negative impact on the competition in rail transport. This impact is limited to the necessary minimum, but it exists. It is, therefore, desirable to focus on support which does not represent state aid as defined in the EU law rather than on granting aid that is compatible with the common market. In this respect, the forms of public funding of rail transport analyzed in this article are quite distinct in nature.

Public financing of rail infrastructure is considered not to represent state aid as it has limited impact on the trade exchange between Member States and it involves no distortion of competition on the EU's internal market (Woll and Meaney, 2017, p. 640; Bacon, 2017, p. 267). Some reservations in this respect need to be made concerning cross-border connections whose improvement may lead to an increase of transport between countries. Although in such case we cannot identify distortion of competition as the railway sector intercepts passenger or freight from other modes rather than induces a new transportation demand. In the Community Guidelines on State Aid for Railway Undertakings (2008/C 184/07), the European Commission notes that if infrastructure use is open to all potential users in a fair and non-discriminatory manner, and access to that infrastructure is charged for at a rate in accordance with the Community legislation, public financing of the rail infrastructure does not constitute state aid. Meanwhile, public funding of PSO contracts represents, for the large part, state aid as defined in the EU law. Such support is governed by the provisions of 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 (OJ L 315/1 3.12.2007). Pursuant to Article 9(1) of this regulation, public funding of public rail transport services granted in accordance with this regulation is considered state aid that is compatible with the common market, i.e., exempt from the prohibition on public aid (Scharf, 2016, p. 310–311).

As already mentioned, the PSO or subsidy schemes may vary significantly among particular countries. Hörcher and Tirachini (2021) reviewed a body of knowledge in this respect depicting different approaches to this issue among researchers since 1970s. As they conclude "the list of the most frequently investigated subjects is dominated by the optimization of pricing and subsidy policies, where scale economies in user and operator costs and substitution with underpriced private car use are the leading mechanisms behind incomplete self-financ-

ing in social optimum". As their study covers more than 300 papers in this field, it is clear that the scheme of public transport subsidies is still considered as a developing area and further research is conducted. In this respect, the following paper contributes to this discussion by analyzing the impact of PSO and investments on railway performance to verify importance of both the support schemes.

3. MATERIAL AND METHODS

To prove the hypothesis put forward in the introduction and taking account of theoretical considerations, a decision was made to choose, for the analysis, all EU member states in the period for which data on total public aid is available, broken down into PSOs and investment. Although, as already mentioned, there are differences in PSO schemes (and rules) regarding services (long distance, regional, urban/suburban), the aim of this study is to depict and analyze PSO in railway sector in general from a horizontal point of view. Authors opted for using passenger- and ton-kilometer indicators. Such a choice stems from the fact that the assessment of the efficiency of rail transport system in respective countries must take account of the complex structure of this sector. By way of example, the EU-level implementation of the model that separates the functions of infrastructure administrators and rail carriers results in the need to choose adequate indicators to enable verifying activities both with respect to infrastructure and PSO.

Yu and Lin (2008) pointed to the differences in those two domains, suggesting a division into technical efficiency and efficiency of services. Technical efficiency of railway transport should be considered in authors opinion by train-kilometers and available seat-kilometers measures. Both indicators present the volume of passenger and freight transport services available. The next step should be to evaluate efficiency of services by assessing their consumption volume. In the assessment, the overall verification of efficiency of the activities undertaken in the sector should be based on passenger- and ton-kilometers as indicators that identify the actual use of rail transports. Passenger-kilometer (pkm) presents the amount of transport performance in a given time. It helps to take account of the weighted volume of short-distance (traveling to centers of gravity) and long-term trips resulting from transport performance, which is of special significance, for example, for transport systems heavily used in urban and regional traffic, where the volume of passengers is higher than in long-distance transport. In this context, it is worth citing the example of Germany, which is characterized by the highest pkm indicator in the EU – in 2018 the transport performance stood at 98.16 million pkm there. In terms of the number of passengers, 2.76 billion passengers were transported on short distance routes in 2018 compared to only 148 million for long distance. However, when assessing those two transport sectors in terms of transport performance, the difference between them is minor. In short-distance services it stood at 57 billion pkm while in long-distance, its value was 43 billion pkm. This example shows the legitimacy of using such an indicator for an overall assessment of the passenger transport sector, taking account of its respective segments.

A similar situation can be observed for freight transport, for which the ton-kilometer indicator is used (tkm). By referring the volume of freight transport services to their relevant distance, it is possible to avoid the artificial overstatement of the indicator where short-term bulk transport plays a major role, e.g., short-distance shuttling between quarries and underground mines, and a maritime port. As in the case of passenger transport, this helps assess

the rail freight sector, taking account of all its segments, while maintaining comparability of results across the countries analyzed.

These indicators are commonly used in the assessment of efficiency of rail transport sector. Catalano et al. (2019) analyzed 144 publications in that regard, verifying their respective elements. In the context of indicators that describe dependent variables, 63% of them used pkm and 59%, tkm. The variables that ranked below them – train-kilometers (in passenger and freight transport) – were used only in 17% and 15%, respectively, of the studies analyzed.

In addition to the above-mentioned indicators used in the study, another assessed aspect was the impact of state support on other variables describing the condition of the rail transport sector. One of the analyzed variables was the level of infrastructure investments in the rail sector. The significance of this variable is due to the amount of invested funds, among other things, which in 25 EU countries exceeded EUR 40 billion YoY between 2005 and 2017, reaching the highest level in 2009 and 2015 – over EUR 48 billion. The last variable used in the study was the value of pkm rescaled using the population figure, which allows a direct cross-referencing and comparison of transport performance on the areas analyzed.

A decision was made to conduct research using panel models with rail transport development indicators as dependent variables, and EU countries' public spending in railway sector in general and as PSO and investment in rail infrastructure as explanatory variables. Also, technical efficiency has been calculated defined as relation between effect scale and infrastructure investment.

Within a random effects model, each country is assigned a certain random variable whose realization accounts for the individual effect in each period. In the random effects model, individual effects are not identical in subsequent periods. As a result, they are not treated as parameters and their value is not estimated. In the fixed effects model, individual effects could be interpreted as an individual intercept parameter, different for each unit but fixed in time, whereas in the random effects model, individual effects can be interpreted as individual random components. An intercept parameter can be introduced in the model:

$$y_{it} = \gamma + X_{it}\beta' + v_i$$

Where v stands for:

$$v_i = \alpha_i + \varepsilon_{it}$$

In addition, the assumption of independence of explanatory variables and random components from individual effects must be met. A low p-value means that parameters in the random effects panel model are compliant and have better estimator characteristics than a fixed effects model.

4. DISCUSSION OF RESULTS

A model regression analysis has been conducted to verify impact of studied variables on railway performance indicators. Hausman test conducted indicates that random effects model has higher quality parameters than fixed effects model. Table 1 presents results of calculations of random effects model calculated using STATA software.

Table 1. Impact of public investment on rail market indicators

Random-effects GLS regression						
					Number of obs =	65
Group variable: Countrycode					Number of groups =	14
R-sq: within = 0.1777					Obs per group: min =	2
between = 0.0662					avg =	4.6
overall = 0.0000					max =	7
					Wald chi2(3) =	7.44
corr(u_i, X) = 0 (assumed)					Prob > chi2 =	0.0591
Mpkm	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
State aid total	-4.28e-10	4.96e-10	-0.86	0.388	-1.40e-09	5.43e-10
State aid infr	-7.10e-10	3.37e-10	-2.11	0.035	-1.37e-09	-4.91e-11
State aid/GDP	2.68e-06	1.75e-06	1.53	0.126	-7.54e-07	6.11e-06
_cons	.0000157	2.71e-06	5.80	0.000	.0000104	.000021
sigma_u	7.264e-06					
sigma_e	4.486e-06					
rho	.72384206	(fraction of variance due to u_i)				

Random-effects GLS regression						
					Number of obs =	61
Group variable: Countrycode					Number of groups =	14
R-sq: within = 0.0118					Obs per group: min =	2
between = 0.0897					avg =	4.4
overall = 0.0673					max =	7
					Wald chi2(3) =	1.01
corr(u_i, X) = 0 (assumed)					Prob > chi2 =	0.7994
Mtkm	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]

Source: Own elaboration.

Availability of data allowed to conduct calculations on 65 observations for passenger transport and 61 observations for freight transport. Adopting significance level of 0,1 results implies a significant impact of infrastructure support on p-km increase as the additional unit of investment limits an effect in p-km measure by 0,4‰. Significant results have been only acquired in respect to the relation of infrastructure investments in passenger transport. This result implies the importance of infrastructure investments and its higher impact on railway performance than other forms of state support granted in this sector. At the same time, a negative regression coefficient needs to be noted, which suggests the necessity to evaluate efficiency of investments and their impact on railway sector. Regarding other variables and their impact on passenger and freight sector, results show no significant impact. Such results support thesis on limited impact of state aid in the forms of PSO on railway sector regarding passenger transport. As for the freight transport, we need to bear in mind its competitive character, which makes its performance more dependent on general situation of economy and markets using railway transport then on level of state aid allocated in this sector. The results of the analysis may at first suggest lack of significant impact of state aid in general or in respect to PSO and infrastructure. However, the analysis of supplement data on railway sector may lead to different conclusion – high heterogenous of this sector among EU countries.

Verification of railway performance data in EU countries brought identification of compelling differences between countries. In passenger transport an average change of pkm variable reached a level of 19% in the 2005–2018 period. The highest increase has been noted in Slovakia (74%) and Estonia (68%), while 10 countries noted an increase by more than 30%. But at the same time, a significant decrease has been noted in Greece (-40%) and Croatia (-39%) and in total 6 countries have reported a decrease by more than 20%. A similar, or even more equally divided situation may be observed in freight sector. In the 2005–2018 period, 12 countries noted an increase of a freight transport performance index (up to 59% in Slovenia) while 13 countries reported a decrease (strongest in Estonia: -76%). An overall average change in tkm mean for all countries situates at -3% level. Taking the above into consideration and acknowledging high heterogeneity of railway sectors in EU countries, the final step has been taken to verify the impact of state aid in particular countries.

Tables 2 and 3 present the results of the conducted panel studies (random effects model calculated using STATA software) showing significant results for respective dependent variables with respect to PSO (in nominal terms or as a share of GDP) and the impact of investment in rail infrastructure on transport performance (passenger-kilometers) for respective EU countries.

Table 2. Impact of nominal PSO on rail market indicators

Country	**Independent variable**	**Dependent variable**	**Number of observations and R^2**	**Parameter estimated (significance)**
Germany	PSO in EUR millions	Rail M tkm	8 0.632	-4.570444 (0.018)
Portugal	PSO in EUR millions	Rail M tkm	7 0.7609	0.5413 (0.010)

Table 2. Impact… (cd.)

Country	Independent variable	Dependent variable	Number of observations and R^2	Parameter estimated (significance)
Spain	PSO in EUR millions	Rail M tkm	7 0.5526	-5.97979 (0.055)
Denmark	PSO in EUR millions	Infrastructure investments EUR	8 0.5930	-851227.3 (0.025)
France	PSO in EUR millions	Infrastructure investments EUR	8 0.8979	1702959 (0.000)
Greece	PSO in EUR millions	Infrastructure investments EUR	8 0.4320	510524.6 (0.077)
Hungary	PSO in EUR millions	Infrastructure investments EUR	8 0.4626	491825.5 (0.063)
Lithuania	PSO in EUR millions	Infrastructure investments EUR	8 0.4035	45000000 (0.091)
The Netherlands	PSO in EUR millions	Infrastructure investments EUR	6 0.8779	1074403 (0.006)
Spain	PSO in EUR millions	Infrastructure investments EUR	7 0.4958	12900000 (0.077)
Sweden	PSO in EUR millions	Infrastructure investments EUR	8 0.4203	122246.7 (0.082)
United Kingdom	PSO in EUR millions	Infrastructure investments EUR	5 0.7828	4693622 (0.046)

Table 3. Impact of PSO as GDP share on rail market indicators

Belgium	PSO as % GDP	Infrastructure investments EUR	8 0.4807	2.32e+09 (0.057)
Latvia	PSO as % GDP	Infrastructure investments EUR	4 0.8841	-2.87e+08 (0.060)
Estonia	PSO as % GDP	Infrastructure investments EUR	6 0.6693	5.11e+07 (0.047)
Finland	PSO as % GDP	Infrastructure investments EUR	8 0.7608	-6.92r+08 (0.005)
Greece	PSO as % GDP	Infrastructure investments EUR	8 0.3977	-1.76e+09 (0.094)

Table 3. Impact… (cd.)

Italy	PSO as % GDP	Infrastructure investments EUR	8 0.553	-3.52e+09 (0.034)
Slovakia	PSO as % GDP	Infrastructure investments EUR	6 0.5931	1.81e+09 (0.073)
Austria	PSO as % GDP	Pkm/population	7 0.9297	0.0163627 (0.000)
Denmark	PSO as % GDP	Pkm/population	8 0.4291	-0.0391586 (0.078)
France	PSO as % GDP	Pkm/population	8 0.6709	0.0013045 (0.013)
Hungary	PSO as % GDP	Pkm/population	8 0.5827	-0.0609007 (0.028)
Poland	PSO as % GDP	Pkm/population	8 0.5594	0.0162847 (0.033)
Portugal	PSO as % GDP	Pkm/population	7 0.4639	0.0099583 (0.092)
United Kingdom	PSO as % GDP	Pkm/population	5 0.7577	0.0580847 (0.055)

Source: Own elaboration.

When analyzing the impact of PSO on the transport performance in freight transport (tkm), a limited impact of the independent variable on the dependent one can be clearly seen. For Germany and Spain the impact is negative and only for Portugal a positive though limited impact of PSO on tkm was identified. Such a situation is particularly due to the limited support for freight carriers from the state. Support most often takes the form of reduced rates of charges for the use of infrastructure for respective train categories (e.g., intermodal in France and Poland), and its volume and value are quite limited, which directly contributes to the limited impact of the level of PSO on freight transport services expressed in tkm.

A different situation can be observed when analyzing the impact of PSO on passenger transport services expressed in pkm. Significant results were obtained in 5 cases, of which in two countries (Croatia, Czech Republic) the impact is negative and in other three countries (Poland, Italy, Austria) it is positive. It should be noted that countries where a negative impact of PSO on pkm was identified are characterized by a higher share of pkm provided under PSO than as part of commercial services (99.2% of pkm in Croatia and 95% of pkm in the Czech Republic, respectively) compared to the countries where a positive effect was identified. In Poland, the share of PSO transport performance reached 85.4% of total transport performance in 2016, in Austria this coefficient stood at 69.4% and in Italy, at 56.5%. The above indicators point out, in the light of the panel study results, that what significantly drives the PSO efficiency is its adequate location rather than maintaining the dominant po-

sition of transport services supported by public authorities. Nevertheless, it should be borne in mind that the increase in transport performance can depend to a significant extent not only on the level of support for PSOs but also on opening the market for commercial transport services.

As regards the impact of PSOs on rail infrastructure investments, a positive impact was observed in 8 countries, whereas a negative impact was identified only in one case. When examining the impact of PSO as a share of GDP on investments, more diverse results were observed, with a positive effect occurring in three cases and a negative one in four. These results show that a decision taken to grant support for rail transport services as part of PSO involves allocation of funds to infrastructure investment activities. The use of such a solution helps achieve synergies between two forms of support for the rail sector. It is quite telling that the positive effect in such terms was identified only in a limited number of cases, pointing to the lack of comprehensive solutions implemented simultaneously in the two aforementioned areas in the most analyzed countries.

The relationship between PSO and the rail network density was identified only in four cases (two with a positive effect and two with a negative one). This impact is significantly limited with respect to value due to national circumstances, where the rail network development on major and most important routes is in a way compensated in parallel by closing traffic on or scrapping lowest-category lines or those used earlier for uniform transport, e.g., of aggregates or bulk cargo.

The last of the analyzed relationships was the impact of PSO on transport performance per capita (pkm/population). The positive impact identified in 5 out of 7 cases indicates that in the five cases the implementation of the policy of support for the rail transport sector brings measurable benefits in the form of increase in transport performance per capita. As the case of pkm was not rescaled to the population size, it should be emphasized that out of five countries where a positive impact of PSO on pkm of per capita (PC) was identified, only the UK is characterized by a high share of PSO (97%) compared to total transport services. All other countries have a much lower coefficient: 85.4% in Poland, 69.4% in Austria, 38% in France and 8.3% in Portugal. At the same time, the share of competitive grant of PSC is the highest in Portugal (100%) and the UK (99%), while other countries have significantly higher share of non-competitive PSC granting. Taking the above into consideration, the conducted study does not support an approach that competitiveness induce added value in the railway sector regarding its performance. An introduction of PSO schemes needs to consider other factors as crucial for development of railways as important part of transportation systems. Analysis of the above results supports an observation formulated in respect to the combined panel estimation for whole analyzed population – it is impossible to indicate countries for which state support as a part PSO is beneficial for all variables illustrating the situation on the rail transport market. This suggests that the efficiency of state support for the rail sector is strongly dependent on specific conditions in individual countries (in freight transport, for example on the structure and destination of cargo transportation, and in passenger transport, for example on the level of urbanization – the existence of strong local traffic generators and a network of long-distance connections). This makes it difficult to identify a single most efficient model of state support for rail transport services, and consequently, to prepare a generally applicable model to assess the effects of public funding allocation as significant differences and local characteristics need to be considered for particular countries.

5. CONCLUSIONS

Railway has some unique strong points: it is a safe and non-polluting mean of transport. Thus, rail transport can greatly contribute to the development of sustainable transport in Europe (Communication from the Commission 'Community Guidelines on State Aid for Railway Undertakings', OJ C 184/13). A well-functioning public transport sector is the foundation of an effective social, economic, and environmental policy (Communication from the Commission on interpretative guidelines concerning Regulation (EC) No 1370/2007 on public passenger transport services by rail and by road, OJ C 92/1). Despite the unquestionable pros of the rail transport, the sector does not enjoy a good image in Europe. According to Eurobarometer study in 2018, an overall population satisfaction index with railway transport has been noted between 29,6% in Austria and 20,8% in Bulgaria with an average for EU at 25,4%. Starting from the 1960s until the end of the 20th century, in general the importance of railway in a transport system steadily declined, while individual road transportation gained a dominant position and rail transport, both passenger and freight, lost its importance compared to other modes of transport. Rail companies were unable to offer reliability and timeliness required by customers, which made them migrate to other modes of transport, especially road transport. State-owned operators had limited incentive to reduce their operating costs and develop new services. Their activities did not bring in sufficient revenue to cover all the costs and the necessary investments (Communication from the Commission Community guidelines on State aid for railway undertakings, OJ C 184/13). Hence, the main reason for the bad situation of the rail transport sector was, particularly, the low quality of rail transport services and the unsatisfactory efficiency of rail companies. Also, the results of those limitations have been strengthen by rapid development of other transport modes, mainly air and road.

The problems indicated are being solved mainly by ensuring adequate public funding for rail transport and, especially at the EU policy level, by introducing competition in rail transport services. Currently, railway is, to a great extent, publicly funded throughout the whole of Europe. This situation will probably not change in the foreseeable future. EU documents provide many forms of public aid for rail transport. In practice, however, financing the infrastructure and transport services is of predominant significance. Having that in mind, the Authors of the article decided to examine how the form of public funding of rail transport in the EU countries translates into the achievement of goals of the EU sustainable transport development policy, i.e., increasing the share of rail in transport services, in particular. In this respect, the Authors also examined the impact of the adopted solutions on the level of competition in the sector. This is more important as public financing for rail transport should not restrict competition, which is perceived by the Commission as the fundamental tool for revitalizing the rail industry.

The analyses presented in the article show that the results achieved by the respective EU countries are only to a limited extent correlated with the overall financing for the rail transport sector and with the level of funding for infrastructure investments. In general, the overall significant impact of railway infrastructure investments is noted only in passenger sector, while the support under PSO does not impact railway sector performance in significant terms. It needs to be noted that some characteristics of countries where significant results have been observed may be also identified in the countries where no significancy of results occurred. We have limited this research for a significant results group, although comparison of

the railway sector characteristics among countries from both groups may be a further research path. Nevertheless, in general, countries that finance infrastructure to a greater extent perform better than those that focus on PSO. Considering that the financing of infrastructure, unlike the PSO financing, has no negative impact on the competition on the rail transport market, it seems that it is around this area that respective countries' budgetary efforts should be centered. This is of particular importance in the context of the growing liberalization of the rail transport sector. Similar conclusions can be also drawn from the report The 2015 European Railway Performance Index (Boston Consulting Group, May 2015). Nevertheless, as the results of the PSO support in particular countries differs to a high extent, a detailed analysis of specific county or regional SPO schemes might contribute to a more thorough understanding of best tailored solutions in this respect – this should be a further research path regarding the most efficient support schemes in the railway sector.

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Torun International Studies

2022, No. 1 (15), pp. 113–131

Published online June, 2022

DOI: http://dx.doi.org/10.12775/TIS.2022.007

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ON THE WAY TO QMS IMPLEMENTATION: THE MAIN MILESTONES AND ISSUES IN EMERGING ECONOMY

ABSTRACT

The aim of the research is to analyze typical problems in the implementation of quality management systems (QMS) on the basis of private production enterprises which operate in emerging economy context and to develop a rational strategic plan for the design and implementation of such a system, taking into account the experience of successful organizations. The main benefits of implementing QMS are presented. In the article it is recommended to consider the formation of QMS as a project with the appropriate stages of activities. The following positions are envisaged at the initiation stage: formalization of the decision on QMS implementation, appointment of project participants, project team training, as well as development of

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mission, vision, quality policy and QMS process structure. At the implementation stage, it is proposed to develop and approve QMS documents, as well as to implement an internal audit program. At the stage of project closure, it is advisable to put into operation the developed system and pass a certification audit in order to obtain a certificate of compliance with the requirements of ISO 9001. The article presents the structure, content, sequence and estimated duration of all the stages of the project, as well as the division of responsibilities between the project team members. Emphasis is placed on the main issues which can arise at different stages of such a project. In the paper the following range of issues was identified: inconsistency of QMS processes structure with the existing organizational structure of the enterprise; incorrect definition of the performance indicators for processes at different hierarchy levels; erroneous decisions in the internal documentation system organizing. In its turn, in the article the causes for the above-mentioned issues were identified, namely: insufficient motivation of project participants, lack of time or other necessary resources, unwillingness to change the current management system of the company, inconsistency of real goals with the stated ones, etc. In the article it is proposed to divide the main causes of issues into three basic groups: by project participants (personal), bureaucratic (systemic) and leadership (administrative). The authors propose a number of measures to minimize the risks of issues in the QMS implementation, and determine the distribution of areas of responsibility for these measures organizing.

Keywords: Quality Management System, ISO 9001 standard, critical success factors, corporative strategy

1. INTRODUCTION

World market globalization and expansion of enterprises economic activity sets a task of compliance to the International Standards for Quality. One of the tools to improve the company's performance and increase its attractiveness to customers, consumers and other stakeholders is the Quality Management System (QMS) based on ISO 9001 requirements. In recent years, the requirements of Ukrainian manufacturers to their suppliers regarding quality of provided products have caught up with European and world practice. Such trends are observed in the enterprises in food, chemical, machine-building, metallurgical industry and other export-oriented spheres, but they become especially more widespread and cover an increasing number of pharmaceutical businesses.

ISO 9001 standards set out the requirements for Quality Management System of an enterprise (company, institution or any other business entity). Compliance with such requirements involves introduction of a number of measures and streamlining of existing processes at the enterprise. Depending on the level of organization of the enterprise business system, the scale of QMS can be seen as either individual improvements or as large-scale strategic changes, but in most cases it leads to changes in the organizational structure, in the instructions, responsibilities and motivation system of employees, in the regulations of company processes, in the system of documentation. Like any reorganizing, the QMS implementation process, firstly, requires the development of an action plan (projecting), and, secondly, faces a number of challenges which are unexpected for both senior management and employees of the enterprise, and which can not only hinder to obtain the desired results, but also to nullify all efforts in general.

2. LITERATURE REVIEW

Studying of works of numerous authors shows that their researches are mostly concentrated in the following areas:

(1) features of implementation in certain countries and businesses; (Bhuiyan & Alam (2005), Faisal (2016), Almeida et al. (2018), Bravi et al. (2019));
(2) reasons and benefits of QMS implementation and certification as well as an impact on companies' performance (Terziovski et al. (2003), Taylor & Wright (2003), Rahman (2001), Salgado et al. (2015));
(3) procedure and main steps of implementation (Kaidalova et al. (2008), Lysenko and Tavluy (2011), Popovych and Galko (2019));
(4) critical success factors (CSF) for QMS implementation (Taylor & Wright (2003), Jabnoun (2005), Kanapathy (2008), Kumar & Kumar (2011), Rani (2013)).

The similar rank of the most investigated topics noted by Galetto et al. (2017), is as follows: (1) the current diffusion of quality certification and its future trend; (2) the reasons that drive an organization toward the acquisition of the certificate; (3) the benefits and the obstacles/drawbacks; (4) the impact of the certification on the economic/financial performance and on the organizational process.

Although the principles of QMS and the ISO standard are the same for all countries and businesses, there are numbers of studies dealing with development and implementation of QMS in certain regions or types of economic activity (Bhuiyan & Alam (2005), Faisal (2016), Almeida et al. (2018), Bravi et al. (2019)). This may occur because of the cultural, social and economic differences between the countries studied, since they exhibit different industrial and economic characteristics (Almeida et al., 2018). Bhuiyan & Alam (2005) consider problematic issues at Canadian enterprises, and find that, "internally driven companies have less difficulty for certain items. Externally driven companies perceived a higher degree of benefits as compared with internally driven companies". For Ukrainian enterprises, the most influential factors are mainly the requirements of counterparties, especially in the case of entering the external market (Lebedynets, 2014). Krasnokutska & Kruglova (2017) state that introduction of QMS is one of the key factors of effective utilization of the resource potential of a company.

Most mentioned authors consider regions and industries precisely to highlight the benefits of implementing, as well as the most influential factors for successful implementation. However, the results of the QMS implementation do not always meet expectations. Thus, Terziovski et al. (2003) conclude that the ISO 9001 certification is not positively correlated with customer satisfaction; Taylor & Wright (2003) noted, that "many companies were still internally focused" and "ISO9000 certified companies did not perform better than non-certified companies", thus not confirming the statement that the company has achieved better performance under the terms of certification. Rahman (2001) has not found any different results between certified and not certified companies, in terms of organizational and financial variables.

Based on the study developed by Salgado et al. (2015), a positive relationship was found between the "number of issued certificates in each country per 1000 inhabitants and the indicators of economic development (Gross National Income Per Capita)".

We share the view of Jamali et al. (2010) that the failure or non-receipt of benefit from the implementation of QMS connects with gaps in understanding or even ignoring the key

factors necessary for successful implementation: "However, in practice many enterprises fail to adopt and implement TQM. Therefore, there is a need for deeper and more systematic assessment of the factors affecting on QMS implementation".

Alič (2013) describes the problem of bureaucratization due to the large amount of documentation of QMS procedures, and notes that "increasing bureaucracy often prevents companies from deciding to implement ISO 9001".

Taylor & Wright (2003) in a large-scale study about implementation of TQM principles put forward a number of hypotheses, from which the following are confirmed: (1) understanding of the purpose of TQM would be significantly associated with the perceived degree of TQM success; (2) the practice of including specific plans and objectives for quality, as a part of the strategic planning process, would be significantly associated with the degree of success from TQM; (3) the position of the person responsible for leading TQM would be positively associated with TQM success; (4) the firms which have been unable to facilitate or motivate the majority of their employees to become involved in TQM are also less likely to perceive TQM as having been successful.

The vast majority of studies are devoted to finding the causes of failures in the introducing QMS or factors that, conversely, contribute to a successful outcome. The basis for the study of such factors are often the assessment criteria used in ISO 9000 that can be compared to the Malcolm Baldrige National Quality Award (MBNQA). There are seven categories of assessment in the MBNQA which are: (1) leadership, (2) information and analysis, (3) strategic planning, (4) human resource development and management, (5) process management, (6) business results, (7) customer focus and satisfaction. G. Jamali et al. (2010) indicate that four factors, namely (1) top management commitment, (2) strategic quality planning, (3) process management and (4) training are driver factors and need serious attention. Jabnoun (2005) relates the effectiveness of the introduction of QMS with the organizational culture.

Basing on conducted literature review, Kanapathy (2008) generalizes eight critical factors of quality management: (1) top management support, (2) quality information availability, (3) quality information usage, (4) employee training, (5) employee involvement, (6) product/process design, (7) supplier quality, and (8) customer orientation.

Kumar & Kumar (2011), using the Exploratory Factor Analysis (EFA), found nine cross-validated TQM implementation constructs: (1) top management commitment, (2) supplier quality management, (3) continuous improvement, (4) product innovation, (5) benchmarking, (6) employee involvement, (7) reward and recognition, (8) education and training, and (9) customer focus; and one outcome construct (product quality).

Rani (2013) substantiates that the main factors of successful QMS implementation are: (1) top management commitment, (2) quality culture, (3) strategic quality management, (4) design quality management, (5) process management, (6) supplier quality management, (7) education and training, (8) empowerment and involvement, (9) information and analysis, (10) customer satisfaction.

Obviously, the number of factors is growing from the older researches to the newer ones, and depends on the industry, type of business, size of an enterprise. Yusof (2000) provides characteristics of a small and medium business and concludes that it is much easier to introduce QMS in a small business, because fewer people are involved in the process. This conclusion seems quite logical, given that most factors are related to interpersonal communications. Although Taylor & Wright (2003) do not find confirmation of the hypothesis that

the size of the customer base would be significantly associated with the perceived degree of TQM success.

Trang & Do (2020) developed a method based on AHP to determine the percent weightings of eight categories of performance criteria in Vietnamese supporting industries. These criteria include management commitment, role of the quality department, training and education, continuous improvement, quality policies, quality data and reporting, communication to improve quality, and customer satisfaction orientation. They came to the conclusion that "management commitment is the most critical factor; among sub-criteria, supports and responsibilities of top management is the most important".

Taylor & Wright (2003) indicate the time-factor, compliance to strategy and the role of top-management and involvements of employees as "deriving success from TQM". Although a lot of attention is paid to the CSF, in our opinion, there is the gap in the methodology of actions to be taken to implement QMS. According to our experience, managers of companies seeking to implement QMS and obtain a certificate of compliance with ISO 9001, often have no idea what actions need to be taken, what measures should be carried out and how long it will take to implement QMS in the enterprise. Nitin et al. (2011) give a whooping comparison of 24 frameworks as given by various NQA's and 14 individual researchers in the light of 26 CSFs of TQM. However, the research focuses on the CSF and not on the process and actions to be performed. There is also a number of issues in the process of QMS implementation, mainly related with the restructuring of the organizational design from functional to processual. But the emergence of other unexpected difficulties can nullify all efforts.

Kaidalova et al. (2008) present a detailed algorithm for implementation of QMS in a pharmaceutical company in accordance with the requirements of ISO 9001 and Good Pharmaceutical Practice. Lysenko and Tavluy (2011) consider the features of QMS in higher education institutions. The authors point to similar problems related to the lack of understanding of the importance or scope of actions for the implementation as well as issues that arise regarding the organizational structure changes (Lebedynets, 2014). Popovych and Galko (2019) describe the risks in the project of QMS implementation, namely the choice of goals, systems and options of quality policy, as well as the risks of leadership and staff involvement. However, in our opinion, creating a universal detailed procedure which would be relevant to a wide range of industrial enterprises is not presented in the mentioned publications, and recommendations for solving problems or risk management are not exhaustive and need to be supplemented.

The aim of the research is to build a detailed plan for the QMS formation at wide range of enterprises: from the pre-project phase to obtaining the ISO certificate. Such an outline will significantly illustrate the project and simplify organizational decisions on QMS, as well as highlight key issues and implementation risks.

3. RESEARCH METHOD AND SAMPLE

Our research is the result of analyzing a number of projects for the practical implementation of the QMS system in 18 Ukrainian enterprises of pharmaceutical (6), food (6), educational (2) and industrial (4: production of packaging, production of chemical compounds, production of printing products) activities of medium and small business. The result of each project was the introduction of TCM, obtaining a certificate of conformity and re-certification in

a year to confirm compliance. The projects were implemented during 2012–2020. The data were obtained from our own practical experience. Observations and recordings of the facts that took place during this project, as well as methods of solving problems became the basis for this material. All stages and problematic moments were fixed in the QMS documentation of the respective enterprises: protocols of meetings of the Quality Project Teams, surveys of needs and expectations of interested parties developed by enterprises, protocols of internal and external audits.

4. RESULTS AND DISCUSSION

Despite the fact that the quality management in a company should be an ongoing process, the implementation of QMS can be considered as a project: from initial decision of CEO and up to implementation of all developed documented procedures and obtaining a certificate of compliance with ISO 9001. These activities have all the properties of the project, namely: (1) the scope is determined by a number of requirements of the standard to which the system must meet; (2) time period means the period from the initiation to getting the first results from implemented procedures and obtaining a certificate; (3) the budget consists of costs a company has to spend. Thus, we consider the implementation of QMS as a project that has the following stages: (1) initiation; (2) planning; (3) implementation; (4) closure.

It is also possible to distinguish the pre-project stage, i.e., analysis of external and internal factors. First of all, there are market requirements in terms of product quality guarantees. The decision to introduce QMS is also prompted by changes in Ukraine's external orientation, namely an increase in the share of EU countries in Ukraine's foreign trade turnover in the first quarter of 2020 to 41.2% (according to Ukraine's foreign trade in goods and services in the first quarter of 2020 (2020)).

These factors lead the top-management or the most active employees of the organization to realize the urgency and feasibility of QMS implemention and certification. Usually there should be collected the data on Certification Bodies and their requirements as well as consideration of resource provision. The pre-project stage can have different duration depending on the degree of influence of factors and the attitude of senior-managers or owners, and ends with an internal meeting (kick-off), which announces the taken decision, formulates the goal and determines the project budget. This is the end of the pre-project stage and the initiation of the project (stage 1).

There are two positions that should be appointed at the internal meeting directly or within a certain period: a project manager (PM); a project team (PT). The previous versions of ISO 9001:2008 required the appointment of a management representative as a special officer responsible for the QMS project implementation and further support. The current version of ISO 9001:2015 does not contain such requirements; thereafter we believe that the latest version of the standard provides the company the choice to appoint one person or a group of people with a specific list of powers and responsibilities to support the QMS. It is good practice to register the decision of the kick-off meeting in organizational documents (such as orders, directives, etc.) in such document as order, indicating the name and position of the project manager, the composition of the project team and a list of its members' authorities and responsibilities.

The appointment of a project manager and the establishment of his terms of reference rightly entail changes in the organizational structure of the company. A good practice, confirmed by the experience of many companies in Ukraine and other countries, is the creation of a Quality Management Department (QMD) and the appointment of a Deputy Director for Quality (DDQ), who acts as a project manager at the QMS system implementation. There is a common mistake made by many enterprises to substitute QMD with technical-quality control units (TC). The latter are usually present in the structure of any manufacturing enterprise and perform the functions of checkup of raw materials, semi-products or finished goods technical indicators. However, the competence of such units is connected only with evaluating the product quality indicators and does not extend to the managerial, assurance or provision activities (e.g., risk management, internal audits, development of corrective action plans, etc.). Under such conditions, QMS requests from external stakeholders (e.g., customers, contractors, etc.) are often addressed to such units as laboratories, production department, etc., but personnel of these units are usually incompetent to respond to such requests.

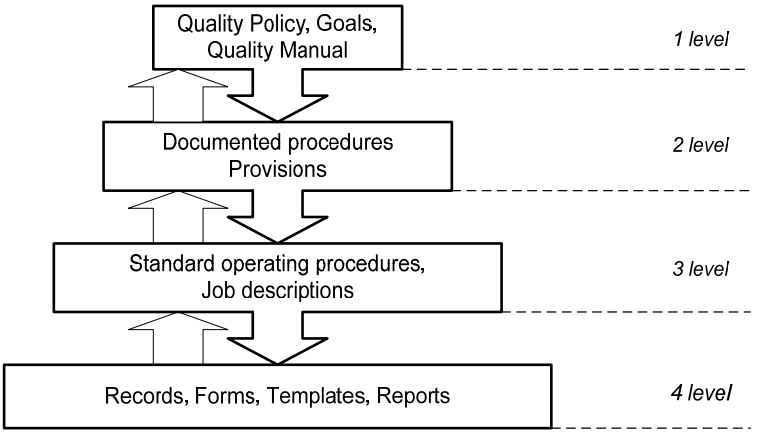
Thus, we consider the appointment of a Deputy Director for Quality to be the best option for electing a project manager. If such a position is not provided, it is advisable to outsource the services and find an external consultant. The project manager and the project team have to carry out a diagnostic audit to identify compliance of the company's actual activities with the requirements of ISO 9001. The report on the results of the diagnostic audit should be considered at the meeting, where the time limits, main stages and budget of the project are adjusted. At this stage, the project initiation is completed.

Project planning (stage 2) is the most time-consuming stage, and involves the following actions: (2A) training the project team; (2B) defining the company's Mission, Vision and Quality Policy; (2C) development of the QMS process structure. The training of PT consists of a series of seminars to study the provisions and requirements of the ISO 9000 standards, and is held in parallel with other processes. Mastering provisions of the ISO 9001:2015 standard will allow to develop the structure of QMS processes, in particular, to make the list of processes necessary for QMS functioning, to define their inputs/outputs, sequence and interaction; determine the leaders (owners) of QMS processes; distribute responsibilities and powers within the QMS.

Defining the goals and performance indicators of QMS processes, methods of their systematic monitoring, as well as identifying and assessing risks and opportunities complete the planning stage. We consider the completion of the planning stage as successful, if the following elements are developed, approved by the company's management and apprehended by employees: (1) mission, vision, quality policy; (2) the scope of QMS; the structure of company's QMS processes (with certain inputs, outputs, resources, management actions) and process-owners; (3) purposes and risks of QMS processes.

Stage 3 of the project can be divided into the following stages: (3A) development and publication of QMS documents; (3B) pre-certification stage; (3C) actual certification. According to DSTU ISO/TR 10013-2003, the set of QMS documentation should consist of four levels (Figure 1).

Figure 1. The typical set of QMS documentation



Source: The authors' own work.

This stage involves:
- determining the structure and content of the QMS documentation;
- creation of a template for documented procedure (DP), then completion of instructions for the DP preparation.

DPs development:
- development and approval of level 3 documents: standard operating procedures (SOP), guidelines, instructions, etc.;
- development and approval of the Quality Manual (not a mandatory document from the standpoint of ISO 9001:2015).

The Quality Manual is the final element in the documentation system. It summarizes the information and essentially presents a "road map" to get an imagination of the whole QMS of the company.

The pre-certification stage begins with the implementation of provisions of QMS documentation into the practice of company's processes, and then the initial registration of data on the effectiveness of the QMS processes. There should be a certain period for data collection. During this period, internal auditors (IAs) should be selected and trained.

The cycle of pre-certification internal audits presents a mini-project, as it requires:
- initiation as selection and training of internal auditors described in detail in ISO 19011:2018 Guidelines for auditing management systems (subsections 5.5.4 and 7.2);
- planning as development of audit program and plans as well as preparation of questionnaires (check-lists) and forms of protocols;
- implementation consists of carrying out internal audits, preparation of reports on the results;
- closure means determination and taking of necessary corrective actions (CA) to eliminate the causes and consequences of the identified nonconformities and preventive actions (PA) to minimize or eliminate of identified risks, preparation of reports on audit results.

The most important element of the post-audit activities is the correction of processes in accordance with the recommendations, monitoring the execution of CA and PA, improving the QMS documentation, etc.

A meeting to assess the QMS's readiness for certification completes this phase. In the case of a positive decision on readiness, the company proceeds to the third step of the implementation stage. The components of this step are following:

- initiations as a selection of a Certification Body and submission of an application;
- planning consists on coordination of the audit plan with the certification body and appointment of a responsible person;
- implementation presents cooperation with auditors, elimination of discrepancies (if any);
- closure consists on obtaining a positive decision of the Certification Body auditors.

The duration of stage 3C will depend on the Certification Body. This paper presents data from common practice.

The closing of the stage almost coincides with the closing of the project. However, any project cannot be considered closed until it has been analyzed and recommendations for further action have been identified. Therefore, the closure of the project involves a report of the project manager at the general meeting of the company, the formulation of recommendations for the future.

The project stages are clearly presented in Table 1. According to our own research, the duration of the project in a medium-sized business is usually from 25 weeks, and traditionally planning and implementation takes 90% of the time. For better understanding later the landscape diagram can be built (Polančič et al., 2020).

Table 1. Step-by-step plan for QMS implementation

№	Stages and content of the main activities	Preliminary act	Start, week	Duration, weeks	Result	Responsible
	1. PROJECT INITIATION					
1A	Initial (kick-off) meeting		1		The order of QMS implementing, PM and PT appointment	CEO (director)
1B	Establishing a QM department or an external consultant attracting (if necessary)	1A	1		The order to specify duties and responsibilities	CEO (director)
1C	Diagnostic audit	1B	1	1	The report of results	PM
1D	Approving of report and recourse assurance	1C	1	1	Project budget	CEO (director)

Table 1. Step-by-step… (cd.)

№	Stages and content of the main activities	Preliminary act	Start, week	Duration, weeks	Result	Responsible
	2. PROJECT PLANNING					
2A	Project Team training	1D	2	4	Evaluation protocol	PM
2B	The development of key QMS documents					
2B1	Establishing a Quality Policy	1D	2	1	Quality Policy	PM / CEO
2B2	Determination Company's context and relevant issues	2B1	2	1		PT/PM / CEO
2B3	Formation of purposes and risks	2B2	3	1	Register of risks and opportunities	PM / CEO
2C	The development and regulation of set of QMS documentation					
2C1	Defining set of QMS processes, as well as their inputs, outputs, sources and receivers	2B3	4	2	QMS process model	PT / PM / CEO
2C2	Defining of process owners	2C1	5	1	Matrix of responsibility	PT / PM / CEO
2C3	Correction of organizational structure and Project Team composition	2C2	5	1	The order of set an organizational structure	PM / CEO
2C4	Determination and approving the purposes and KPI of processes	2C3	6	1	Purposes register	PT / PM
2C5	Identifying risks and opportunities	2C4	7	1	Risks register	PT / PM
2C6	Coordinating the purposes, risks and opportunities of processes throughout the system	2C5	8	1	QMS process model corrected	PT / PM / CEO
	3. IMPLEMENTATION					
3A	The development of QMS documentation					