8th INTERNATIONAL CONFERENCE
''TOWARDS A HUMANE CITY''
New Mobility Challenges
Novi Sad 11th and 12th November 2021

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MANAGING THE SUSTAINABILITY OF ROAD FREIGHT TRANSPORT: OVE HUMAN INDICATOR

Key Words
Fleet
Sustainable
Environmental
Efficiency

Abstract

An advanced and responsible community shall raise awareness on the need for its own sustainability and create impacts through formulation of ethical principles and adoption of legal guidelines. Transport needs to strive towards sustainability that is defined inter alia, through efficient use of renewable energy resources. In order to reach transport process sustainability objective, one needs to establish a methodology and to define, determine, adapt and apply indicators and methods for transport industry management.

This paper presents an application methodology for a sustainability management indicator and method, and proposes a cycle to be applied when developing the method and the overall indicator of overall transport process effectiveness in freight transport and sustainable transport in general. The paper deals with the development cycle, while the indicator itself and the calculations were presented in previous papers by the listed authors.

1. INTRODUCTION

There are two main determinants arising from transport process sustainability. The first is to determine an indicator for overall transport process effectiveness, and the second is to define a method to improve the overall transport process effectiveness in general. Through application of indicators and methods one is able to manage the transport process effectiveness, to make decisions in accordance with the set objectives and to take actions towards their implementation through effective use of available resources. The subject of this paper is to define a methodology for calculation of indicators and methods which serve to manage the transport process and sustainable transport in general. The goal of the paper is to present a cycle that needs to be applied when defining methods and indicators, and that is integral part of the Total Productive Maintenance methodology. The paper demonstrates the importance of a sustainable transport process and describes the applied methodology. Furthermore, the paper lays out a cycle how to develop an overall transport effectiveness improvement indicator and method in freight transport, as it goes through the stages of defining the objectives, as-is analysis and indicator selection, measurements, definition and implementation of improvement programs and finally, performance measurement and evaluation.

2. SUSTAINABLE TRANSPORT PROCESS

Sustainable transport process is an aspect of global sustainability. It can be defined as „transportation that does not endanger public health or ecosystems and meets needs for access consistent with use of renewable resources at below their rates of regeneration and use of non-renewable resources at below the rates of development of renewable substitutes“ [1].

According to the given definitions, transport needs to strive towards sustainability, which is defined, inter alia, by efficient use of renewable energy resources. Even though this objective is not yet achievable, transport development guidelines reflect energy efficiency, environmental protection, use of renewable energy sources, etc. [2].

Transport demand created by the society in the above manner has been set out only when the industry and the society reached the current level of development, and the current degree of awareness of the importance of sustainability. A developed and responsible community builds awareness of the need to be sustainable and exerts influence through formulation of ethical principles and adoption of legal guidelines. There is a tendency to develop a rational transport process which meets achievable criteria imposed by both the community and the industry in parallel. This is exactly one of the challenges within the HORIZON 2020 Program (Smart, Green and Integrated Transport). A sustainable transport process developed in this way may stimulate: improvement of vehicle fleet energy efficiency, more efficient utilization of resources used for transport process realization, reduced share of transport costs in the product price, improved traffic safety, reduced dependency upon non-renewable

energy sources, increase in gross domestic product rates, better living surroundings, a cleaner and healthier environment and a safer future for new generations.

On the other hand, transport process in the given settings needs to be managed and improved in line with the objectives of sustainability. Managing a transport process comprises adaptation to modern and future technological demands in terms of: manufacturing and packing of goods, manufacturing and procurement of means of transport, vehicle operation and maintenance, transport service, infrastructure, etc.

Achieving a sustainable transport process is a goal that can be realized through mutual interaction between relevant stakeholders, in particular:

- the government, i.e. the community,
- the academic, professional and scientific community, and
- vehicle fleet owners.

The state, as a socio-political community, creates the most favourable solution for its citizenry based on the current internal state of affairs, but in interaction with the surroundings. Moreover, the authorities establish transport policies, guidelines, deadlines for their application, define limitations, degree of freedom and the settings for sustainable transport realization. The task of the academic, professional and scientific community is to indicate the consequences of the upcoming development, which will enable the state to amend the transport policies and make sound decisions. Practical application of results from different scientific and professional research efforts and analyses how to adopt and implement transport policies represent a transport policy challenge. Majority of research results at universities and research institutes do not have sufficient practical influence on transport policy decisions. Numerous research results are exchanged mostly only inside the academic community and are neglected by executive authorities for various reasons. Vehicle fleet owners provide road transport services to commercial activities in order to meet demand on the market. The authorities do not determine what services are to be rendered, where nor at what time. These are commercial decisions that are made by vehicle fleet owners in cooperation with their users. The main goal for vehicle fleet owners is to increase the benefits, i.e. to increase the profits. They adjust their performance to the settings defined and seek higher profits through rationalization.

Transport process management pursuant to sustainable development criteria was first defined at the 1992 summit in Rio under the sustainable development plan for XXI century, called Agenda 21. In the Republic of Serbia, *The First Action Plan for Energy Efficiency of the Republic of Serbia for the period from 2010 to 2012* (adopted at the Serbian Government session held on July 29th, 2010) is of major importance for sustainable transport process. For the first time, the Plan has introduced European energy efficiency standards, promoted eco-driving, introduced transport process effectiveness management, energy management, made provisions for incentives to replace existing fleets, etc.

3. SUSTAINABILITY MANAGEMENT

In order to achieve the objective of transport process sustainability, it is required to establish a methodology and to define, determine, adapt and apply indicators and methods used for managing the transport industry. In the Republic of Serbia, no indicators or methods conducive to sustainable transport process management are applied, and there are no road transport-oriented models available. It is important to develop, to scientifically and professional justify and verify indicators and methods in this area, because of the effects that may be exerted onto this economic activity. The following has been used as a starting point to develop the methodology:

- No indicators for road freight transport effectiveness monitoring have been defined;
- It is evident that there is a need to ensure a harmonized, interactive and simple indicator, easy to understand, applicable in all parts of the transport process, defined so as to accurately evaluate the ratio between the activities that add value to the transport process and those that do not;
- No methods for transport process effectiveness measuring are applied,
- It is possible to develop a method to improve the overall effectiveness so as to make decisions sustainable for the transport process;
- Decision at certain management levels are made ad hoc, based on available but mostly imprecise and incomplete parameters, and
- Evaluation of effects brought on by the applied measures is mostly just formal, and its vertical and horizontal integration, as well as integration into the decision-making process, is negligible.

The methodology is based on the Total Productive Maintenance (hereinafter: TPM), i.e. the TPM approach, modified in the function of studying and analysing the directions and impacts of the indicators upon the improvement of the transport process in general. This methodology covers a cycle comprised of: definition of objectives, as-if analysis and selection of indicators, measuring, defining and implementation of improvement programs and evaluation of outcomes.

The result of such a comprehensive approach is reflected in the fact that indicators and methods for managing a sustainable transport process, i.e. transport sustainability, are hereby defined.

The OVE Human method (OVE - *Overall Vehicle Effectiveness,* hereinafter: OVE) is applied in companies dealing with road freight transport [2]. The objective is to improve the effectiveness of resources and existing capacities. The objective needs to be achieved without considerable additional investments, but rather through better organisation of operation, systematisation, reorganisation of jobs, the technological process, sustainable procurements, etc. The objective can be achieved through the following tasks: improve fleet and driver effectiveness, improve energy efficiency and improve service quality.

Through application of the TPM approach and its benefits, the OVE Human indicator of the overall transport process effectiveness needs to go through the development stages in the identical way as the OVE indicator when Simons and authors of [3] and

[4] were developing this indicator based on the OEE - *Overall Equipment Effectiveness* (hereinafter: OEE) indicator, viz.:

- A method was developed by considering possible applications in local settings, using the knowledge and experience of vehicle fleet managers for the territory of the Republic of Serbia. A concept for an overall vehicle fleet operation efficiency indicator was presented and it was investigated whether the indicator could been applied in companies managed by these fleet managers. Review of the relevant literature, interviews with vehicle fleet managers and the analysis of current indicator application revealed details how data collection was organized. Data which were difficult to collect were defined. For some, a different collection method was defined, while others were excluded from further consideration.
- Findings obtained in the first stage were used to improve and to modify the overall transport process effectiveness indicator. Indicators that comprise this particular indicator were specified, together with respective data collection methods. The indicator of overall transport process effectiveness was titled OVE Human, because its calculation included evaluation of the availability, performance and quality of staff operation. OVE Human was then presented at the 2016 Transport Congress, and the congress participants underscored the importance of investigating the impacts of energy efficiency and staff performance quality indicators upon the transport process itself.
- Finally, at the end of the research, several vehicle fleet indicators were analysed, managers, heads and dispatchers were interviewed and also vehicle fleet data bases were analysed.

Indicators or data comprising complex indicators need to be accessible (available), measurable (precise for quantification purposes), easily verified (valid) and sensitive in the local settings. A disadvantage of indicators presented by authors of [5] and [6] is that they are limited only to studies for which they were defined, developed and applied. Each of the indicators given in [6] has one or more disadvantages in terms of availability of data required for calculation, accuracy of the data collection method and validity with regard to whether it is possible to verify the value of a resulting data or indicator.

In order to further use data used for OVE Human calculation in the same form as presented or proposed, it is required to consider their sensitivity to the disadvantages observed. Availability, accuracy and validity of data and indicators used for calculation of indicators were presented in [6].

3.1. As-is analysis

In order to apply the method for overall transport process effectiveness improvement it is required to analyse the current situation. Such as-if analysis needs to be carried out based on available data. If data required for the as-if analysis are not available, then it is required to collect historic data on vehicle fleet and driver operation. An as-

if analysis determines the functioning of the transport process and identifies areas for improvements and future care. An as-if analysis comprises the following steps: criticality assessment, current assessment, renewal and future care about the transport process.

Criticality assessment serves to assess the state of vehicle fleet operation and to establish relative criticality for each vehicle, organisational part and all activities in the transport process, which then further enables forecasting of priorities for renewal, future vehicle care, changes in the operation organisation i.e. improvement of elements that affect the overall fleet effectiveness most. Moreover, special attention needs to be given to the management mechanisms and operating methods. Dispatchers, drivers, maintenance crews and other employees (operators, process stakeholders) need to be involved in the identification of the most critical activities in the transport process from their own perspective. Each vehicle and each activity are evaluated against the following criteria: suitability for implementation of the activity, reliability from the operators' point of view, impact of failures or implementation problems upon quality of operation, losses due to failure, safety, environment and costs.

Current assessment is an assessment of critical activities that affect the transport process state. Current assessment is made per activities in the transport process. Hereby, current functionality of the transport process activities is determined and activities are identified and ranked according to priorities for improvement.

Current assessment is used as the basis for renewal plans in order to establish such transport process state where maximum effectiveness would be achieved. The purpose of renewal is to abide by the instructions from the previous step.

Future care about the transport process follows the renewal. It is required to anticipate future care measures, plans and programs for implementation of activities, funds, operators and vehicles, which will ensure that the transport process is realized as foreseen.

In order to define deviations, monitoring activities need to be determined. Best monitoring practices are ensured when the operator of an activity is allowed to inform the operator of another, related activity at the moment when the process starts to degrade, but before it becomes critical.

3.2. Measuring the effectiveness

Measuring provides a value that denotes the effectiveness of vehicles, drivers and the quality of service. Measuring is done after the as-is analysis and it needs to be repeated after the improvement program has been implemented. It is important that each subsequent transport process effectiveness measurement results in higher OVE Human indicator values, which would indicate that the effectiveness has been improved. Measuring serves to assess the current value of transport process effectiveness and to set a reference baseline for future improvement measurements. In order to perform a successful measurement, a sound information base is required, as well as an extensive indicator for overall transport process effectiveness

improvement. Data needed to perform the measurement, i.e. historic vehicle and driver operation data, comprise the information base. These data are included in electronic data bases of operating hours, vehicle monitoring, procurements, storage, book-keeping, etc. Such data can be retrieved directly from travel orders, work schedules, log books, maintenance work orders, records made by supervisors, etc.

3.3. Improvement program and possible effects

Transport process improvements need to be constant in terms of scope and period of time. Application of the kaizen approach implies small yet constant improvements. Improvements realized in this way yield best results - resistance by the surroundings is the lowest, results inevitably come, and employees are satisfied to contribute to a measurable quality.

Improvement programs comprise the following: definition of the improvement program, implementation of the improvement program, and best practise examples and knowledge base.

Application of this overall transport process effectiveness improvement method is expected to increase the value of the developed OVE Human indicator [5], and to improve the transport process in general. It revaluates and establishes potential losses and applies various improvement measures in order to influence the achieved values of the OVE Human indicator. Application of the method developed is expected to yield positive effects in the transport process, i.e. improvement of all measured parameters.

These effects should enable planned transport process and fleet activities to be realized with as low overall costs as possible in the given period. If an organization decides to fully and consistently apply this overall transport process effectiveness improvement method, it can be expected that the organization will define a world class effectiveness that it will strive to achieve. Hereby, the set OVE Human indicator application goal – improvement of the transport process effectiveness - would be achieved. For manufacturing organizations, the literature [7] and [8] specifies that the world class score corresponds to the overall effectiveness value of 0.85.

According to many researchers, one of the more prominent measures that improves vehicle fleet energy efficiency is improved cargo hold utilization in vehicles, [2] and [6]. Furthermore, the manner in which drivers operate vehicles has a strong impact upon energy efficiency. Building awareness with drivers, providing relevant trainings on economical and eco-driving and monitoring drivers' performance may increase the energy efficiency of the vehicle fleet. Outcomes are evaluated using values calculated for individual indicators and the extensive indicator of the overall transport process effectiveness, OVE Human [2].

4. CONCLUSION

The paper presents a methodology for application of sustainability management indicators and methods, and the development cycle of a method and an extensive

indicator for overall transport process effectiveness improvement in freight transport, and sustainable transport in general. The paper describes the development process, while the indicator itself and the calculation are given in other papers by the same authors. The calculation is based on the determination of vehicle and driver availability utilization rate, vehicle and driver performance rate, quality of the service rendered from the perspective of the user, energy efficiency and the operator [6]. Moreover, the paper specifies an adapted procedure and a cycle to be operated in order to achieve the desired effects and to improve the overall transport process effectiveness. Consistent application of methods and indicators requires certain investment, both in terms of time and funds. The methodology shown in this paper has been adapted to the setting of the Republic of Serbia and it proved to be suitable for overall transport process effectiveness improvement and improvement of sustainability of transport in general. Results of the application of this methodology are given in papers by the same group of authors, [2, 5, 6].

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