



INTEGRATED LOGISTICS MANAGEMENT SYSTEM FOR OPERATION OF MACHINERY AND EQUIPMENT

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ABSTRACT. Background: The main issue in the operations of machinery and equipment, which is the subject of theoretical and empirical research is to provide high reliability and durability with qualitative post-trade services of machinery and equipment. Quality of service can be achieved through planned maintenance activities supported by computer technology. The article presents the concept of an integrated system of logistics management operation of machinery and equipment, especially special one for stationary transport equipment. At the outset, it emphasized the importance and essence of technological transport and storage systems storage in modern manufacturing enterprise. Then the objective and the method of research have been set. An essential part of deliberations in the article is the concept of integrated logistics management system operation for stationary transport equipment. Authors of this article have presented the results the implementation and operation of the system. The results are presented in a descriptive and graphic form.

Methods: The purpose of this article is to present the concept of implementing an integrated logistics management system for operation of stationary transport equipment. It goes through combination of planning, event logging service, warehouse management in the field of spare parts, account and records of the cost of service activities. The paper presents an analysis and evaluation method of brainstorming a new approach to logistics management operation stationary transport equipment. Authors takes into account the specific conditions of use of transport equipment and conduct the service, which have a significant impact on the time and place of cost and service as well. It should be noted that the developed system has been implemented. It was also carried out an assessment of its functionality and efficiency as the new IT tool for logistics management operation.

Results and conclusions: The paper presents a new concept of integrated logistics management of operation for the stationary transport equipment system. Specific conditions relating to the operation of these devices have been identified. This is essential prerequisites for the development of the concept of the computer solution. The article presents the concepts of the inclusive servicing of warehouse management and cost accounting records and maintenance. Comprehensive integration of these aspects creates a new opportunities in logistics in the field of the operation for stationary transport equipment. This way of design, implementation and recording of maintenance work supported by the integrated management system is a modern tool for conducting maintenance. It's should be mentioned that this conception remains in competition with traditional servicing operators servicing.

Key words: management, management system, logistics operation.

INTRODUCTION

Stationary transport systems are used in many sectors of the global economy. Raw materials and products are transported by means of so-called conveyor system and storage. Reliable operation of these

systems is a prerequisite for trouble-free use of all further devices in the logistics chains of different production processes and transport. Therefore the reliability and use of stationary transport systems are put very high demands. Stationary transport and storage systems are used in the economy, including in:

- coal, lignite mine and mineral resources,

- heat and power plants,
- steel mills and cement plants,
- automotive industry,
- ports.

In technological transport systems and storage we can distinguish the following carriers:

- belt,
- roller,
- chain,
- bucket,
- worm,
- special purpose, and others like complete lines for the continuous transport.



Source: www.fugor.com.pl

Fig. 1. The technological transport of lignite opencast mine (conveyor belt)

Rys. 1. Transport węgla brunatnego (pas transmisyjny)

PLACE OF LOGISTICS SERVICE IN ENTERPRISE

Logistics is defined as the process management of movement of goods and / or persons and activities supporting these processes in systems in which they occurred [Słowinski, 2009]. It follows that the essence of logistics management is to link the processes of movement. That is why logistics is now included in the core business as for example factors of value added (Fig. 2).

Efficiency of movement processes, use of modern IT tools in controlling these processes, economics of operation and cost reduction are necessary conditions to maintain the market position. The most important task of logistics at the operational level is optimization of

the five basic factors: time, space, quantity, size range and information. Thus, regardless of the substance of the concept of logistics, it should be able to answer for a string of questions: what? to whom? where? when? how much? how? The answers of these questions about the client - manufacturer, are in fact essential for the success of any enterprise.

Logistics, which have been started, it is development of the configuration: production-transportation-storage-stocks, constantly expanding the sphere of their interests. Today - on the basis of logistics - you can now build an integrated business management system and determine the strategic directions of the growth of its effectiveness. Logistics also entered into the field of quality and reliability. Now also increasingly unites its objectives with the strategic and operational management of the company [Słowinski, 2009].

One of the key tasks performed by each company's is logistics customer service – the common area of marketing and logistics in the company. Presented in the literature synergistic areas of marketing and logistics are related with logistics customer service processes. It taking place in the distribution of products [Schenk, 2010].

Marketing focuses on customer service in the field of communication, especially interpersonal one, and also as part of the distribution strategy involving the creation clients the ability to purchase products company [Strojny, 2011]. Logistics customer service concerns the distribution of products in an optimal way, so that the customer received the product in the right quantity and condition, and to allow him to get on the effects of supply at a particular time and place [Pokusa, 2001].

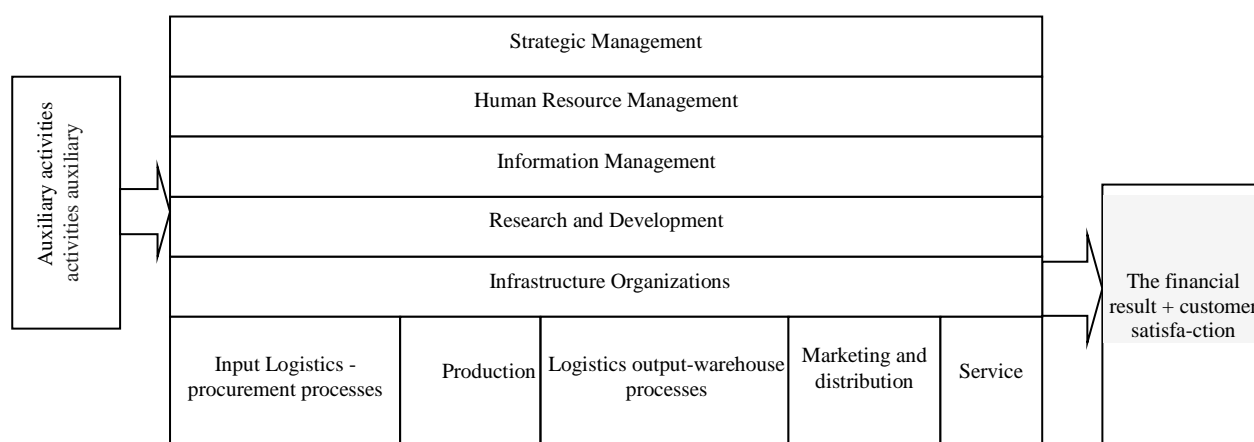
Logistics customer service in the field of marketing and logistics is analyzed and presented in the literature in the form of three phases:

- pre-trade phase, which refers to the policy of the company in the preparation of customer service, service policies, the adequacy of the organizational structure and the flexibility of the customer service process,

- phase of the transaction, which decides on the proper and consistent with the client's expectations of the process of the transaction (purchase), and covers the time from order placement until the transfer of the product to the customer,
- post-trade phase, which involves actions to support reliable and durable operation of the product during use (operation) on the client. It includes such activities as installing (first run), maintenance and warranty and post-warranty repairs,

modernization and installation of additional equipment, training for customers in the use of the products, complaint procedures, delivery of materials and spare parts.

Therefore, the logistics operation belongs partially to pre-trade phase in terms of developing policy and partly - to post-trade service. It covers all the activities related to the reliable operation of the product at the customer.



Source: the authors of the paper

Fig. 2. The Place of operational logistics in the creation of value-added businesses
Rys. 2. Rola operacji logistycznych w tworzeniu wartości dodanej przedsiębiorstwa

Reliable use of machinery and equipment, including stationary transport equipment, requires a systemic approach to service, and so - do their service and repairs and periodic inspections. Planning, organizing and conducting activities service and repair of transport equipment and storage technology is a demanding task of engineering and technology. Much space is also devoted to this issue in the studies of H. Wildeman. Thus, a necessary condition for the implementation of these measures is the use of computer technology-based logistics management system operating in the field of maintenance and repair stationary technological transport and storage. So the decision-making process for the effective and timely implementation of tasks in line with the strategy of the company

is necessary, first of all, to build operational plans. They are essential elements of decision-making to create relationships in the production function [Mleczo, 2008].

We must also remember that production planning, scheduling and control operations forces to use both the various technologies and methodologies, including the production function. The use of systems such as Just in Time, MRP, ERP and Kanban will accurately plan production requirements. The rules control the production, may be included in the five points, which are:

- agreed production plan,
- fast and effective way to manage change,
- control of production scheduling system,

- production under conditions of limited capacity,
- availability and accuracy of data [Towers, 2008].

PROJECT SERVICE FOR FIXED TRANSPORT EQUIPMENT

Service activities in the logistics operation of machinery and equipment encountered a number of problems, which arise primarily from the fact that [Antoniak, 2007]:

- Fixed transport equipment are often subjected to extreme and its intensity strongly varying operating conditions impeding planning point of time and the scope of service and repair work. The reasons in this regard are: the impact of weather conditions for the operation of the open space, scuffing and wear through the material transported (e.g. dust). Other important matter is large variations in the behavior of these devices in terms of susceptibility to damage and failures as a result of changing operating conditions. Thus, the planning point of time and the scope of service and repair work is extremely difficult.
- Transport equipment often contain a large number of widely spaced points requiring maintenance service activities. At the point of use devices with virtually no information about the disposal of property maintenance and its history. It means that maintenance work will be carried out without targeting them to the correct destination and often by using a lot of work and resources.
- Documentation of maintenance work and repair or results of technical inspections creates problems, because the documentation directly on the site is often difficult and requires a lot of work. The implementation period for maintenance & repair and their documenting are sharing now considerable periods of time. This is related to the danger of incorrect and incomplete documentation of performed maintenance activities.

For overcome these shortcomings, you will clearly improve both maintenance and corrective actions in the context of quality and

reliability of the equipment, while maintaining the same cost or even reducing them. So it becomes necessary to take appropriate action relating to the operation and overhaul and repair. As a result of exploratory studies the following tasks was carried out:

- gathering the necessary information concerning the operation of the transport device and the necessary tasks to perform maintenance and repair work directly on-site by an employee performing maintenance or repair,
- specification of conditions for documenting the activities performed service-repair or results of technical review directly on-site
- providing conditions for the central storage, analysis and evaluation of information relevant to the implementation of measures to repair & maintenance and preparation of the data for planning, accounting and control of maintenance activities.

These considerations were the basis for the development and application of computer technology-based information and management system, called logistics management system for stationary transport equipment operation [Reichel, 2009]. This system has the following functional characteristics:

- provides records data directly in the place of use, and transfer of data to the central data bank without further manual processing them,
- documented and accounted for maintenance and service work,
- prepares and offers service status information for object in order to prepare and carry out the necessary work to repair & maintenance,
- prepares the current data of the periods of machine downtime associated with planned treatments and service - repair, consumable materials and spare parts and the cost of service and repair work,
- documented reliability and identify their weak points,
- prepares the information for operational and strategic planning service and repair.

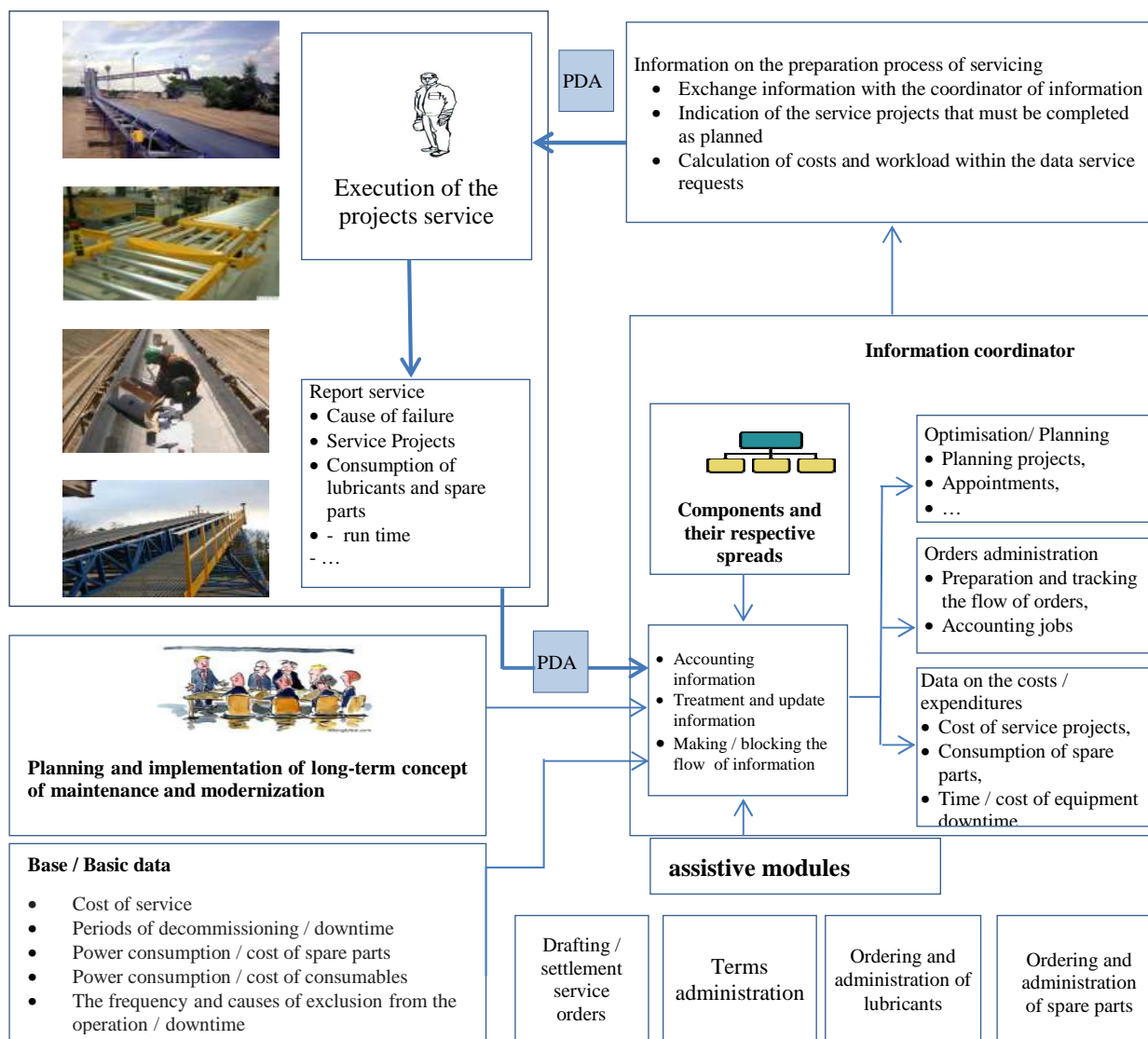
This system has the following characteristics:

- some functioning and reliable data storage,

- easy to use without any special knowledge in the field of computer technology,
- environmental compatibility of enterprise information technology,
- possible low cost of acquisition, use and maintenance.

CONCEPTION OF LOGISTICS MANAGEMENT SYSTEM FOR OPERATION OF STATIONARY EQUIPMENT TRANSPORT

Functional characteristics and structure developed logistics management system operation is shown in Figure 3.



Source: the authors of the paper

Fig. 3. Functional characteristics and structure of logistics management system for operation of stationary transport equipment

Rys. 3. Charakterystyka funkcjonalna struktury systemu zarządzania logistycznym działaniem stacjonarnego wyposażenia transportowego

Presented system has been developed for the purpose of service of conveyor systems and storage, and it is possible to use regardless of the type and area of use of the facilities. For

each of the cases, it is necessary - before you start - the introduction of baseline data, specific to several device (in the case of this project, the object of study are conveyors).

These tasks can be carried out on the basis of the computer program documentation by the employee which has a basic knowledge about electronic records and data processing. Logistics management system for operation stationary transport equipment developed in the following stages:

- structural separation in terms of transport equipment service and work - repair maintenance,
- technological preparation and organization of the service and work - repair maintenance,
- develop baseline data as a list for the "service equipment",
- installation and commissioning of the "service equipment",
- use (testing) program and correction.

TECHNOLOGICAL PREPARATION AND ORGANIZATION OF SERVICE WORK

Technological basis for the preparation and organization of service work create the relevant documents from the manufacturer and the user of the device. In this case that are: the stationary transport equipment, as well as applicable laws, standards, rules and regulations. In particular, one should take into account the specific service processes and practical expertise and experience of employees. Service projects can be planned with regard to their implementation point of time and the content and scope.

For this purpose, the necessary data are entered into the correct directory data in the logistics management operation. That type of the system is installed in the base unit. It is a computer located in the service department, it works with a mobile unit in order to record the data.

DATA BASE INPUT

The baseline data are the basis of the data program. They are stored in directories underlying data. When one use the program they are called and if necessary - updated by writing down information by user of

the program (e.g., type, content, point in time, service projects). The user accesses the corresponding windows that contain a number of texts help, including information on produced data. Text help facilitate data entry as well.

Baseline data are divided into the following categories: customers, location of equipment, cost centers, suppliers, types of equipment, materials, parts, materials, performance, parts, service personnel, operations, machinery.

Relevant data base allows the user to program making contact in the form of oral or written with the principal of servicing - repair task or employee of his own company. It becomes necessary, for example, when one will decide to carry out unplanned, required maintenance projects. Available "entry" windows for the introduction of data flows presents program homepage of the that is called "service equipment".

MOBILE DATA REGISTRATION

Mobile Registration data and their transmission to a central computer database is done by using a standard PC PDA - Pocket (Fig. 4), and the process of accounting data and the transmission is shown in Figure 5.



Source: the authors of the paper

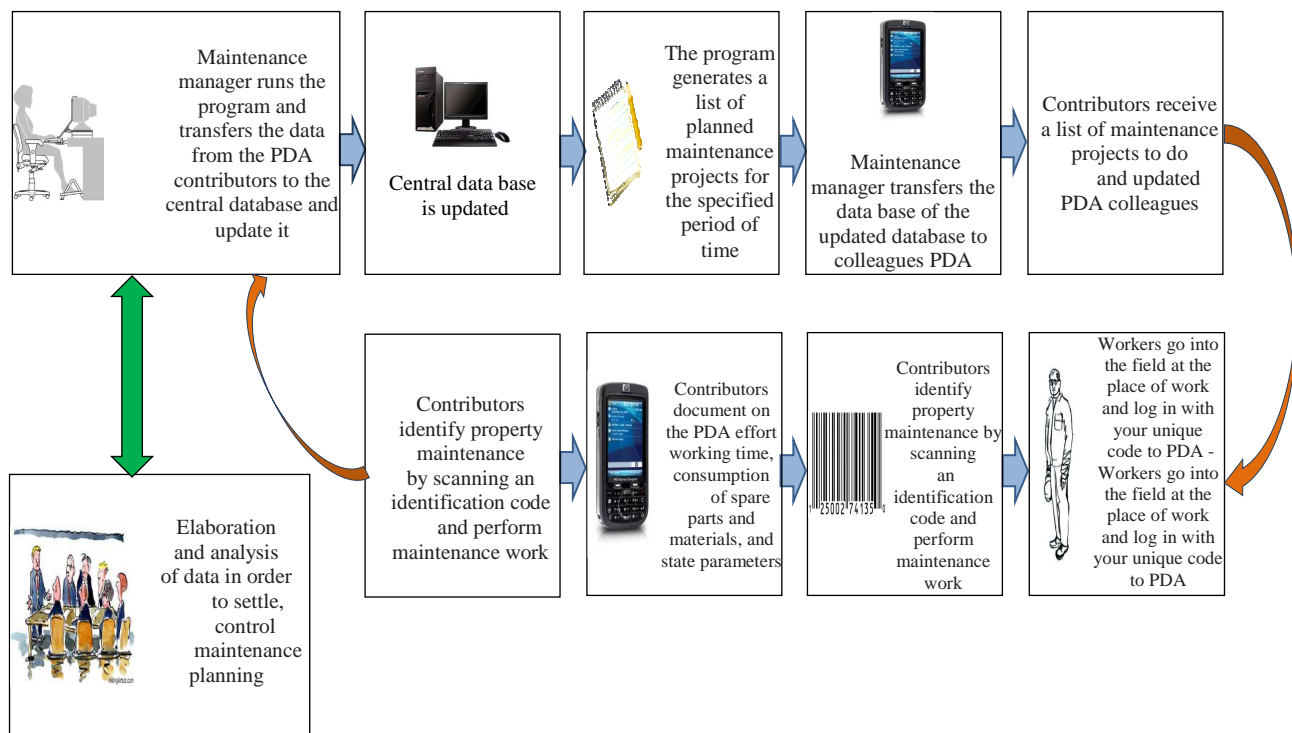
Fig. 4. Input Window PC PDA - Pocket - Registration

Rys. 4. Strona wejściowa PC PDA

After logging by using a personal password it's possible - for the purpose of documenting planned to carry out the service - to choose different input window and records the data.

By pressing the buttons the user accesses the database introduced into the PDA (e.g. the list of machines). By clicking on the current machine, used lubricant or other items included on the lists, they are properly taken into the input window. It is a way of reducing the workload for documenting the maintenance project and increases the quality of the recording of data. The data

documented in the PDA which concern the carried out service are sent by using the transfer station to a central database. In the updated database data are collected and made available for the purpose of further evaluation and analysis, such as the settlement of warranty made or post-warranty maintenance.



Source: the authors of the paper

Fig. 5. The algorithm for recording and transmission data by using a standard PC PDA - Pocket
Rys. 5. Algorytm zbierający i przekazujący dane przy zastosowaniu standard PC PDA-Pocket

The purpose of the proper and reliable functioning of the "service equipment" its installation along with connecting functions, i.e. mobile handheld Pocket PC type - mobile data records. It should be done by a specialist service department in the field of electronic data processing and accounting. As part of the development of the software installation and using the "service equipment" is included. It should be done by using generally occurring and operated enterprises, standard computer equipment (hardware) and basic software

(software), such as a computer running Microsoft Windows Professional.

It is expected that as a result of planned further research will be formulated practical guidance on opportunities to improve and streamline the management system. They will be implemented in the framework of the final modification and improvement program within the author's own research. Its value in use will be verified practically at its dissemination.

SUMMARY

The use of computer technology - based on logistics management system for operating stationary transport device contributes significantly to the elimination of currently outstanding service errors in the use and repair of warehouse transport systems and technology. As part of own research was developed adequate system of logistics management operation of machinery and equipment, and completed work on a software and IT technical implementation of the system. Service management system for stationary transport and the associated software are - after proper alignment - possible to apply for service management of machinery and equipment in all sectors of the economy.

REFERENCES

- Antoniak J., 2007. Przenośniki taśmowe w górnictwie podziemnym i odkrywkowym [Belt conveyors in underground and quarrying mining], Wydawnictwo Politechniki Śląskiej, Katowice.
- Bruhn M., 2007. Marketing, Gabler Verlag, Wiesbaden.
- Gładysiewicz L., 2003. Przenośniki taśmowe, teoria i obliczenia [Belt conveyors, theory and calculations], Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław.
- Mleczek J., 2008. Komputerowe wspomaganie planowania przebiegów procesów produkcyjnych [Computer-aided planning of production processes waveforms]. Wyd. FCNT, Bielsko-Biała, 37.
- Pokusa T., 2001. Logistyczna obsługa i lojalność klienta jako orientacje rynkowe [Logistics service and customer loyalty as market orientation], Wyższa Szkoła Zarządzania i Administracji, Opole.
- Reichel J., 2009. Betriebliche Instandhaltung, Springer-Verlag, Berlin
- Schenk M., 2010. Instandhaltung technischer Systeme: Methoden und Werkzeuge zur Gewährleistung eines sicheren und wirtschaftlichen Anlagenbetriebs. Springer-Verlag Berlin.
- Schenk M., 2010. Innovative Lösungen für die Instandhaltung von Anlagen: 11. Industriearbeitskreis "Kooperation im Anlagenbau". Verlag Fraunhofer Irb Stuttgart.
- Słowiński B., 2009. Inżynieria zarządzania procesami logistycznymi [Engineering management of logistics processes], Wydawnictwo Naukowe Politechniki Koszalińskiej, Koszalin.
- Strojny S., 2008. Przesłanki standaryzacji interpersonalnej obsługi klienta [Conditions of standardization for interpersonal customer service], *LogForum* 4,1,4.
- Strojny S., 2011. Koncepcja zintegrowanej obsługi klienta - ujęcie procesowe [The concept of an integrated customer service - Recognition Process], *Logistyka* 5, Instytut Logistyki i Magazynowania, Poznań.
- Towers N., 2000. Execution of short term production planning with virtuous manufacturing: Towards a paradigm for small and medium sized enterprises operating in a supply chain, Responsive Production and the Agile Enterprise, Proceedings of the 4th International Conference on Managing Innovative Manufacturing, Birmingham, Aston University, 626.
- Wildemann. H., 2010. Integratives Instandhaltungsmanagement. 6. Auflage, TCW Transfer-Centrum GmbH & Co. KG, Muenchen

www.famak.pl

www.fugor.com.pl

www.erneuerbare-energien.de

ZINTEGROWANY SYSTEM ZARZĄDZANIA LOGISTYKĄ EKSPLOATACJI MASZYN I URZĄDZEŃ

STRESZCZENIE. Wstęp: Podstawowym zagadnieniem w eksploatacji maszyn i urządzeń, które stanowi przedmiot rozważań teoretycznych jak i badań empirycznych jest zapewnienie ich wysokiej niezawodności i trwałości poprzez jakościową obsługę potransakcyjną. Jakość serwisu można osiągnąć poprzez planowe działania obsługowe wsparte technika komputerową. W artykule zaprezentowana została koncepcja zintegrowanego systemu zarządzania logistyką eksploatacji maszyn i urządzeń, szczególnie stacjonarnych urządzeń transportowych. Na wstępie zaprezentowano znaczenie i istotę systemów transportu technologicznego i magazynowego współczesnego przedsiębiorstwa produkcyjnego, następnie określono cel i metodę badań. Zasadniczą część opracowania stanowi opis koncepcji zintegrowanego systemu zarządzania logistyką eksploatacji stacjonarnych urządzeń transportowych. Zaprezentowano efekty wdrożenia i funkcjonowania systemu. Wyniki przedstawiono w formie opisowej i graficznej.

Metody: Celem opracowania jest zaprezentowanie koncepcji wdrożenia zintegrowanego systemu zarządzania logistyką eksploatacji stacjonarnych urządzeń transportowych, poprzez połączenie procesów planowania, rejestrowania zdarzeń serwisowych, gospodarki magazynowej w zakresie części zamiennych, rachunku i ewidencji kosztów działań serwisowych. W artykule przedstawiono analizę i ocenę metodą burzy mózgów nowego podejścia do zarządzania logistyką eksploatacji stacjonarnych urządzeń transportowych, uwzględniając specyficzne warunki ich eksploatacji i prowadzenia prac serwisowych, które mają istotny wpływ na czas i miejsce powstawania kosztów prac serwisowych. Opracowany system wdrożono w praktyce gospodarczej. Dokonano też oceny jego funkcjonalności oraz efektywności, jako nowego informatycznego narzędzia wspierającego proces zarządzania logistyką eksploatacji.

Wyniki i wnioski: Opracowanie prezentuje nową koncepcję zintegrowanego systemu zarządzania logistyką eksploatacji stacjonarnych urządzeń transportowych. Zidentyfikowane zostały specyficzne uwarunkowania dotyczące eksploatacji tych urządzeń, które stanowiły istotne przesłanki do opracowania koncepcji programu informatycznego. W opracowaniu zaprezentowano koncepcję programu integrującego prace serwisowe z gospodarką magazynową i ewidencją oraz rachunkiem kosztów prac serwisowych. Kompleksowa integracja tych obszarów stwarza nowe możliwości w logistyce eksploatacji stacjonarnych urządzeń transportowych. Tak zaplanowane i realizowane oraz ewidencjonowane prace obsługowe, wsparte zintegrowanym systemem zarządzania należy traktować jako nowoczesne narzędzie prowadzenia prac serwisowych, które stanowi konkurencję dla tradycyjnych operatorów prac serwisowych.

Słowa kluczowe: zarządzanie, metoda zarządzania, operacje logistyczne.

INTEGRIERTES SYSTEM FÜR LOGISTIK-MANAGEMENT DER AUSNUTZUNG VON MASCHINEN UND EINRICHTUNGEN

ZUSAMMENFASSUNG. Einleitung: Die Hauptfrage der Ausnutzung von Maschinen und Einrichtungen, die den Gegenstand sowohl theoretischer, als auch empirischer Erwägungen ausmacht, ist die Gewährleistung einer hohen Zuverlässigkeit und Beständigkeit durch einen entsprechenden Qualitäts-Service der in Betrieb genommenen, technischen Anlagen. Die erwünschte Qualität des Services kann mit geplanten, rechnerunterstützten Service-Leistungen erreicht werden. In der Arbeit wurde ein Konzept des integrierten Systems für Logistik-Management der Ausnutzung von Maschinen und Einrichtungen, insbesondere von stationären Transport-Anlagen, dargestellt. Einleitend präsentierte man die Bedeutung und das Wesen von Transport- und Lagersystemen innerhalb eines gegenwärtigen Produktionsunternehmens, nachfolgend bestimmte man das Ziel und die Methode für die durchzuführenden Forschungen. Das Konzept des integrierten Systems für Logistik-Management der Ausnutzung von stationären Transport-Anlagen macht den Hauptteil der Arbeit aus. Es wurden Ergebnisse der Einführung und Betätigung des Systems präsentiert und sie in einer die Systemfunktionalität kommentierenden und grafischen Form projiziert.

Methoden: Das Ziel der Arbeit war es, ein Konzept des integrierten Systems für Logistik-Management der Ausnutzung von stationären Transport-Anlagen auszuarbeiten und es einzuführen, und dies anhand einer Integration von Planungsprozessen, der Erfassung von Service-Ereignissen, ferner durch eine effiziente Lagerwirtschaft im Bereich der Bewirtschaftung von Ersatzteilen, Bestandsführung und Identifikation der Kosten von Service-Leistungen. In der Arbeit stellte man mittels eines "Brainstormings" die Analyse und Einschätzung eines neuen Herangehens an die Fragen des Logistik-Managements bei der Ausnutzung von Transport-Anlagen dar, und dies unter Betrachtung von spezifischen Betriebsbedingungen der Transporteinrichtungen und der Durchführung von Service-Leistungen, die einen wesentlichen Einfluss auf die Zeit und den Ort der Entstehung der Kosten von Service-Leistungen ausüben. Das konzipierte System wurde eingeführt und die Einschätzung dessen Effektivität und Funktionalität als eines Informatik-Werkzeuges für die Betriebslogistik vorgenommen.

Ergebnisse und Fazit: Die Arbeit präsentiert ein neues Konzept des integrierten Systems für das Logistik-Management bei der Ausnutzung von stationären Transport-Anlagen. Es wurden spezifische Betriebsbedingungen solcher Einrichtungen, die wesentliche Voraussetzungen für die Ausarbeitung des Konzeptes eines Informatik-Programms schufen, ermittelt. Im Rahmen des Vorhabens wurde das Konzept eines Programms, das die Service-Leistungen mit der Lagerwirtschaft, Evidenz und Kostenrechnung von Service-Ereignissen integriert, ausgearbeitet. Die komplexe Integration dieser Funktionsbereiche schafft neue Möglichkeiten innerhalb der Logistik beim Betreiben von stationären Transport-Anlagen. Die auf diese Art und Weise geplanten, realisierten und evidenzmäßig erfassten Service-Dienstleistungen, die von einem integrierten Management-System unterstützt werden, sollen als ein modernes Tool für die Durchführung der Service-Leistungen angesehen werden. Solch ein Konzept und Herangehen an den Kundenservice sind durchaus wettbewerbsfähig im Verhältnis zu herkömmlichen Anbietern von den betreffenden Service-Dienstleistungen.

Codewörter: Management, Management-System, Logistik von Maschinenausnutzung.

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