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REVERSE LOGISTICS AND WORN-DOWN TYRES

OBRNUTA LOGISTIKA I POHABANE GUME

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Abstract: *The article deals with the possibilities of application of worn-down tyres reverse logistics, concrete with processes of collection, sortation and processing of these tyres.*

Key words: *Reverse Logistics, Worn-Down Tyres*

Apstrakt: *Ovaj rad se bavi mogućnostima primene obrnute logistike za pohabane gume, tačnije procesima prikupljanja, razvrstavanja i prerade takvih guma.*

Ključne reči: *obrnuta logistika, pohabane gume*

1 INTRODUCTION

Wastes production is the part of mankind existence and the quantity of wasted increases with the developmnet of production. It is possible to solve the problem of wastes by application of reverse logistics and it can use by the biggest commodity od wastes – worn-down tyres.

2 REVERSE LOGISTICS

The term „reverse logistics" begins to use in the ninetieth years of the last century, but it was not in this form, but as a reverse distribution of logistics of reverse flows. It was directed to two important subject category [1]:

1. returned goods to seller,
2. recycling of communal and industrial wastes.

1 UVOD

Proizvodnja otpada je deo čovekovog postojanja i sa razvojem proizvodnje količina otpada postaje sve veća. Moguće je rešiti problem otpada primenom obrnute logistike koja se može koristiti kod otpada najrasprostranjenije vrste robe - pohabanih guma.

2 OBRNUTA LOGISTIKA

Izraz „obrnuta logistika" počeo je da se koristi devedesetih godina prošlog veka, ali ne u tom obliku već kao obrnuta distribucija i logistika obrnutih tokova. Bila je usmerena na dve važne kategorije subjekata [1]:

1. roba vraćena prodavcu,
2. reciklaža komunalnog i industrijskog otpada.

At the present time we can state, that there is the under standing between these categories and we can define (according to literature) reverse logistics as a part of logistics which is concerned with the management, assurance and realization of back-flow of raw materials, materials in the collecting and conduting networks which are destined from customers to the point of processing [1,2,3].

Danas možemo reći da postoji veza između ovih kategorija i možemo definisati (prema stručnoj literaturi) obrnutu logistiku kao deo logistike koja se bavi upravljanjem, osiguranjem i realizacijom povraćaja sirovina, materijala u mrežama prikupljanja i praćenja koje kreću od kupaca ka stanicama za preradu [1,2,3].

By this definition of reverse logistics we can determine the basic parts of reverse logistics which are in the Table 1.

Ovom definicijom obrnute logistike možemo odrediti osnovne delove obrnute logistike koji se nalaze u Tabeli 1.

Table 1 Basic parts of reverse logistics
Tabela 1 Osnovni delovi obrnute logistike

What is?	Inputs	Activities	Outputs	From	To
process	rejected products	planning	recycable products	the point of consumption	makers
task	used products	implementation	recycling		central collection spots
capabilities	packages of products with dangerous properties	control	reprocessing		point of origin
activities		collection	disposal		
	information	transport	reduction		
	raw materials	stock-keeping	control		
	in-process supplies	transfer	reacquired products		
	finished products	reduction			
	related information	disposition			

It is possible to transform the former definition of reverse logistics to this form: The main content of reverse logistics is collection, sortation, disassembly and processing of used products, parts, by-products, redundant supplies and packaging materials, where the basic target is the assurance of new use or material evaluation by the way which is thrifty to environment and interesting for economics.

Prethodnu definiciju je moguće preformulisati u sledeću: Glavni sadržaj obrnute logistike je prikupljanje, razvrstavanje, demontaža i prerada korišćenih proizvoda, delova, nus-proizvoda, viška zaliha i ambalaže, pri čemu je osnovni cilj obezbediti ponovno korišćenje ili materijalnu valorizaciju na način koji je neškodljiv po životnu sredinu i koji je ekonomski isplativ.

2.1 INTEGRATION OF REVERSE LOGISTICS TO THE LOGISTICS SYSTEM

The reverse logistics creates independent logistics system or it is the part of enterprise logistics system, where it co-operates with the basic objects of logistics [6], as are financial, information, material flows, flows of people, goods and auxiliary materials.

The reverse logistics presents activities which influence the functional region of enterprise – on the strategic, tactical and operative level [1,2,3].

2.1 INTEGRACIJA OBRNUTE LOGISTIKE U LOGISTIČKI SISTEM

Obrnuta logistika stvara nezavisni logistički sistem, odnosno, ona je deo logističkog sistema preduzeća, gde deluje zajedno sa osnovnim predmetima logistike [6], kao što su finansijski, informacioni, materijalni tokovi, tokovi ljudi, robe i pomoćnih materijala.

Obrnuta logistika predstavlja aktivnosti koje utiču na funkcionalnu oblast preduzeća – na strateškom, taktičkom i operativnom nivou [1,2,3].

2.2 GENERAL CHARACTERISTICS OF REVERSE LOGISTICS NETWORKS

Supply chain and the network of reverse logistics are characteristics in several differences and in the first place the element of reverse logistics present these differences:

- used product from consumers,
- wastes and material loss related to the production,
- returned goods and packages.

Four basic activities prevail in the network of reverse logistics. These activities are:

- gate keeping,
- collection,
- separation,
- removal/reprocessing.

There are the network of „classic" logistics (characterized by supply chain) and the network of reverse logistics in the Figure 1.

2.2 OPŠTE KARAKTERISTIKE MREŽA OBRNUTE LOGISTIKE

Lanac nabavke i mreža obrnute logistike imaju nekoliko razlika u karakteristikama, a na prvom mestu kod obrnute logistike postoje sledeće razlike:

- korišćeni proizvod od potrošača,
- otpad i gubitak materijala vezani za proizvodnju,
- vraćena roba i ambalaža.

U mreži obrnute logistike preovlađuju četiri osnovne aktivnosti. To su:

- čuvanje ulaza (zaliha),
- sakupljanje,
- separacija (razdvajanje),
- uklanjanje/prerada.

Postoji mreža "klasične" logistike (koju karakteriše lanac nabavke) i mreža obrnute logistike kao na slici 1.

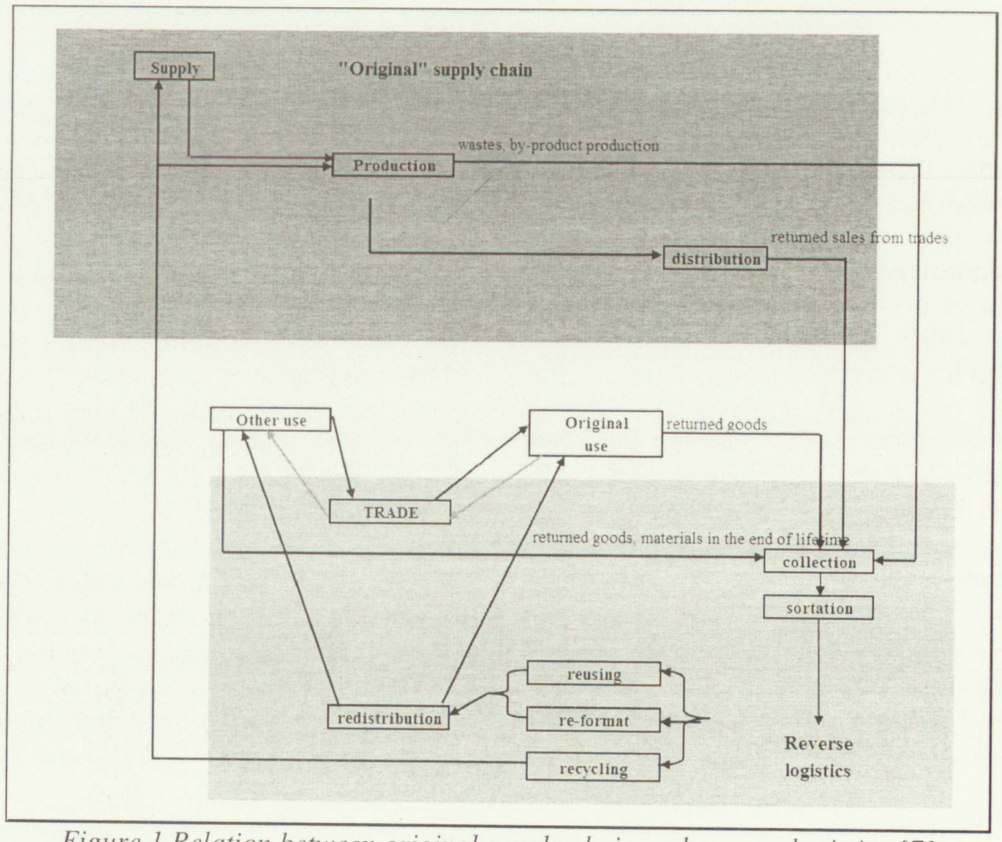

Figure 1 Relation between original supply chain and reverse logistics [7]
slika 1 Odnos između prvobitnog lanca snabdevanja i obrnute logistike [7]

3 REVERSE LOGISTICS SYSTEM DESIGN WITH WORN-DOWN TYRES APPLICATION

By reverse logistics system design for worn-down tyres it is possible to proceed in four steps:

1 The process of worn-down tyres collection

1.1 Present situation in the process of collection of worn-down tyres
1.2 Creation of centralized collection spots

2 Present situation of processing industry for worn-down tyres

2. 1 Evaluation of present capacity eith the emphasis on the prognosis of worn-down tyres growth
2. 2 Contingent design of new processing industry for worn-down tyres

3 Setting optimal transport line (from centralized collection spots to processing industry)

4. Design verification by the help of simulation program ,Extend", definition of critical points.

On the basis of this procedure it was created the system of reverse logistics for the condition of Slovak republic. In the first place it was prognosticated the growth of wastes from worn-down tyres. The prognosis was dedicated from the „Program of waste management of SR", concrete from the condition of collection: 2,79 kg of worn-down tyres per inhabitant [4].

After that for the process of collection, it was designed the model of collection, which is oriented to the centralized collection spots for the concrete region of SR, with the complying of the quantity of collection by the „Program of waste management of SR". For the establishing of centralized collection spots it was used the Cooper-iterative method. Thos method goes from geometric principle, which means that the considered consumers and suppliers are plotted to the Cartesian coordinate system and the target is optimal coordinate of centralized collection spots finding [8].

From observed result it determines concrete regions for centralized collection spots allocation. After that (with complying of processing industry of worn-down tyres in Kechnec – V.O.D.S., Inc.,

3 IZRADA SISTEMA OBRNUTE LOGISTIKE UZ PRIMENU ISTROŠENIH GUMA

Po nacrtu sistema obrnute logistike za pohabane gume, proces se može izvršiti putem četiri koraka:

1 Proces prikupljanja pohabanih guma

1. 1 Sadašnja situacija u procesu prikupljanja pohabanih guma
1. 2 Stvaranje centralizovanih mesta za prikupljanje

2. Sadašnje stanje industrije prerade pohabanih guma

2. 1 Procena sadašnjeg kapaciteta uz akcenat na prognoziranje povećanja pohabanih guma
2. 2 Moguće projektovanje novog postrojenja za preradu pohabanih guma

3. Postavljanje optimalne transportne linije (od centralizovanih mesta za prikupljanje do postrojenja za preradu)
4. Provera dizajna pomoću simulacionog programa „Extend", definisanje kritičnih tačaka.

Na osnovu ovog postupka izrađen je sistem obrnute logistike za uslove koji vladaju u Republici Slovačkoj. Na prvom mestu, predviđen je porast otpada od pohabanih guma. Ova prognoza je izvedena iz „Programa za upravljanje otpadom u Republici Slovačkoj", tačnije iz podataka nakon prikupljanja: 2,79 kg pohabanih guma po stanovniku [4].

Nakon toga, za proces prikupljanja je izrađen model prikupljanja, koji je usmeren ka centralizovanim mestima za prikupljanje za konkretan region Republike Slovačke, uz pridržavanje propisane sakupljene količine određene „Programom za upravljanje otpadom u Republici Slovačkoj". Da bi se odredila centralizovana mesta prikupljanja, korišćena je Cooper-ova iterativna metoda. Ova metoda polazi od geometrijskog principa, što znači da su u pravougli koordinantni sistem uneti razmatrani potrošači i dobavljači a cilj je optimalna koordinata u nalazu centralizovanih mesta za prikupljanje [8].

Iz dobijenih rezultata određuju se konkretne oblasti za raspored centralizovanih mesta prikupljanja. Nakon toga (uz pridržavanje pravilnika u postrojenju za preradu pohabanih guma u Kechnec – V.O.D.S.,

Slovakia) it was defined transport line. The transport line is in two ways: high line and down line, with the economic savings [5].

In conclusion the reverse logistics model was verified by the help of simulation program „Extend". There is preliminary level of simulation model in the Fig. 2.

Inc., Slovačka) utvrđena je transportna linija. Transportna linija ide u dva pravca: u gornjem i donjem smeru, uz ekonomsku uštedu [5].

Na kraju je ovaj model obrnute logistike proveren pomoću simulacionog programa „Extend". Na slici 2 dat je preliminarni nivo simulacionog modela.

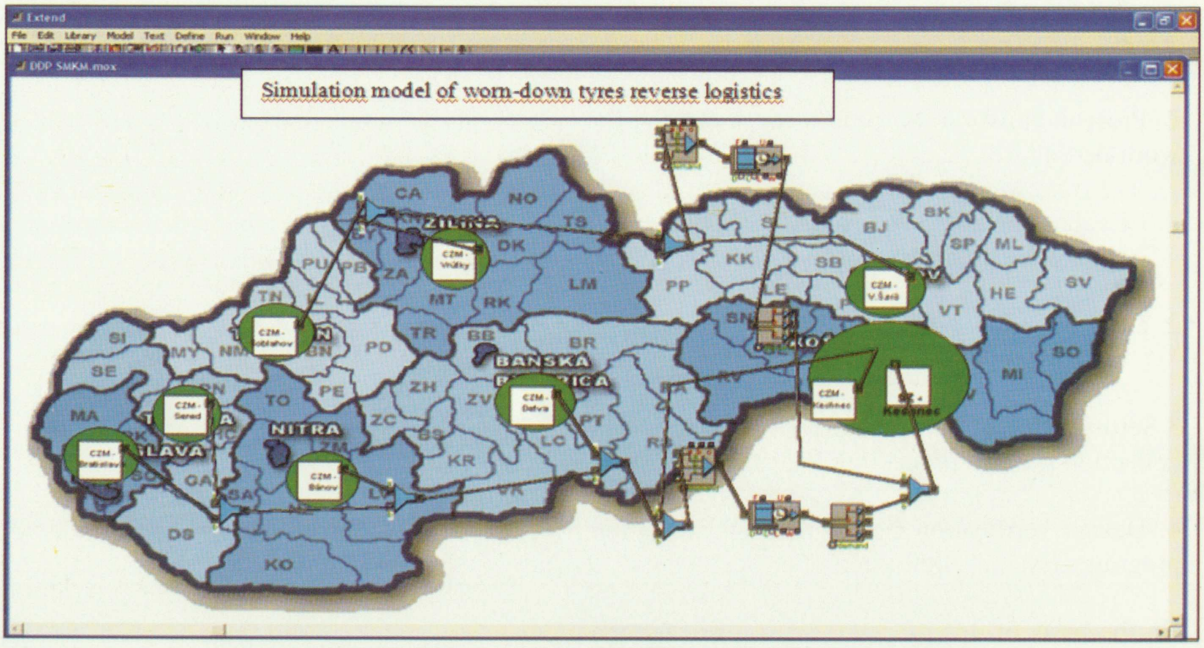

Figure 2 Simulation model of worn-down tyres of reverse logistics
slika 2 Simulacioni model za pohabane gume u obrnutoj logistici

Outputs from the simulation model are:

- planned quantity of worn-down tyres,
- quantity of worn-down tyres,
- quantity of transported worn-down tyres from centralized collection spots to processing industry,
- quantity of output materials from worn-down tyres.

Učinci simulacionog modela su:

- Planirana količina pohabanih guma,
- Količina pohabanih guma,
- Količina transportovanih pohabanih guma od centralizovanih mesta za prikupljanje do postrojenja za preradu,
- Količina materijala dobijenih preradom pohabanih guma.

4 CONCLUSION

Success of waste management of every state and industry is dependent on the existence and fluent activity of co-generating partial parts of waste management with the implementation of reverse logistics processes.

Application of reverse logistics in the industry, concrete by the solution of worn-down tyres disposal, is wide-spectrum and it is needs to direct the solution of this problem to the general

4 ZAKLJUČAK

Uspeh upravljanja otpadom u bilo kojoj državi i industriji zavisi od postojanja i nesmetanog toka aktivnosti za ko-generisanje delova upravljanja otpadom uz implementaciju procesa obrnute logistike.

Obrnuta logistika ima široku primenu u industriji, tačnije uz pomoć rešenja za odlaganje pohabanih guma, i potrebno je usmeriti to rešenje problema na opšti plan

level and realize the use of reverse logistics in the account of the whole system.

At the conclusion it is necessary to accentuate that the created model of reverse logistics of worn-down tyres is possible to realize in the practise by full support (primarily financial support) Recycling foundation, legislative and last but not leas environmental consciousness of every consumer, producer and demand account for producted wastes. Summarily, it is possible to state that the created model of reverse logistics with the orientation to the prime extent of the collection, through of central collection places, we can apply in the event of every commodity of wastes.

i realizovati upotrebu obrnute logistike u okviru celokupnog sistema.

Kao zaključak, potrebno je naglasiti da je stvoreni model obrnute logistike pohabanih guma moguće realizovati u praksi uz punu podršku (prvenstveno finansijsku podršku) Fondacije za reciklažu, zakonodavstva, i na kraju, što nije manje važno, uz ekološku svesnost svakog potrošača, proizvođača i zahteva da se vodi računa o proizvedenom otpadu. Ukratko, možemo reći da stvoreni model obrnute logistike, usmeren ka glavnom području prikupljanja, preko centralnih mesta za prikupljanje, možemo primeniti za otpad proistekao iz svake vrste robe.

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