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RISK ANALYSIS OF FREIGHT FORWARDERS' ACTIVITIES IN ORGANIZATION OF INTERNATIONAL COMMODITY FLOWS

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Abstract: Realization of international commodity flows is prerequisite of economic development. Organization of international commodity flows is a very complex and responsible task. Freight forwarders and logistics providers are architects of mentioned flows. They have to coordinate a large number of processes and executors in a synchronized chain. For that reason, they must have multidisciplinary knowledge to make this possible. However, the realization of a large number of activities and the presence of a various participants are accompanied by numerous risks and problems. They can endanger the flow and greatly slow it down. In this paper freight forwarders risks in the process of organization of international flows are analyzed. For risk analyses FMEA approach, as one of the most frequently used approaches is used. The most important risks in the processes of preparation and goods loading, export clearance, documents preparation, transport, import clearance, unloading, cost calculation and payment are identified. According results the most important risks are: wrong loading (unloading) address, taking incomplete (unchecked) documentation, bad communication (lack of information), traffic congestion, congestion on the border and customs offices, bad anticipation of unexpected costs. Each risk is characterized by certain parameters important for corrective and preventive actions. In the observed example it was found a great applicability of the FMEA approach.

Keywords: international commodity flows, risks, freight forwarder, FMEA.

1. Introduction

International trade flows are very intensive and important for each country. The exchange of goods is not only realized between neighboring countries, but also between countries located on different continents. The growth of international trade and the centralization of production over the last two decades have significantly influenced the organization of international commodity flows. Many countries recognized that the trade play major role in the economic growth (Kilibarda and Andrejić, 2017).

Freight forwarders and logistics providers play a key role in the organization of these flows. They are responsible for the organization and implementation of all activities, as well as for connecting of all participants in the chain. They are, among other things, responsible for the organization of shipping, transport, warehousing,

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clearance, insurance, etc. One of the basic activities is customs clearance, both export and import customs clearance. Customs clearance is the most important factor in international trade. Country competitiveness is result of customs service efficiency and effectiveness (Zamora - Torres *et al.,* 2013).

In the network of processes and participants there are numerous risks for logistics providers. Potential risks can greatly disrupt flows and make a lot of problems for all participants. In that manner, delays in transport, documentation problems, customs congestion, payment problems are just some of the problems in organization of commodity flows.

The need for identification and management of these risks is evident. There is a lack of papers that deals with mentioned risks and problems. This paper analyzes in more details the risks of freight forwarders in the organization of international commodity flows. The papers are organized as follows. The next section gives the detailed description of main processes in international flow organization. The failure mode and effects analysis (FMEA) approach are described in third section. The fourth section analyses application of FMEA method in the observed case. At the end of the paper concluding remarks and directions of future research are given.

2. Organization of International Flows - Basic Processes

As mentioned before, the organization of international commodity flows is a complex and often uncertain process (Kilibarda *et al.,* 2016). The main tasks of freight forwarders and logistics providers are to design, organize and realize international goods flows, in accordance with the requirements and disposition of customers. After conduction of purchasing contract between the seller (exporter) and the buyer (importer), it is necessary to organize the import and export goods flows. For the designing, organizing and realizing logistics processes in the import and export goods flows, the seller and buyer mainly engage freight forwarders and logistics service providers. The exporter or importer, as users of logistics services, give a request to freight forwarding companies. Based on information in request logistics company forms and provides the appropriate logistic offer (Figure 1). After accepting the offer by the customer comes to conclusion of the contract of freight forwarding, between the customer and the logistics company. After that, the process of organizing and realizing the international trade flow is starting.

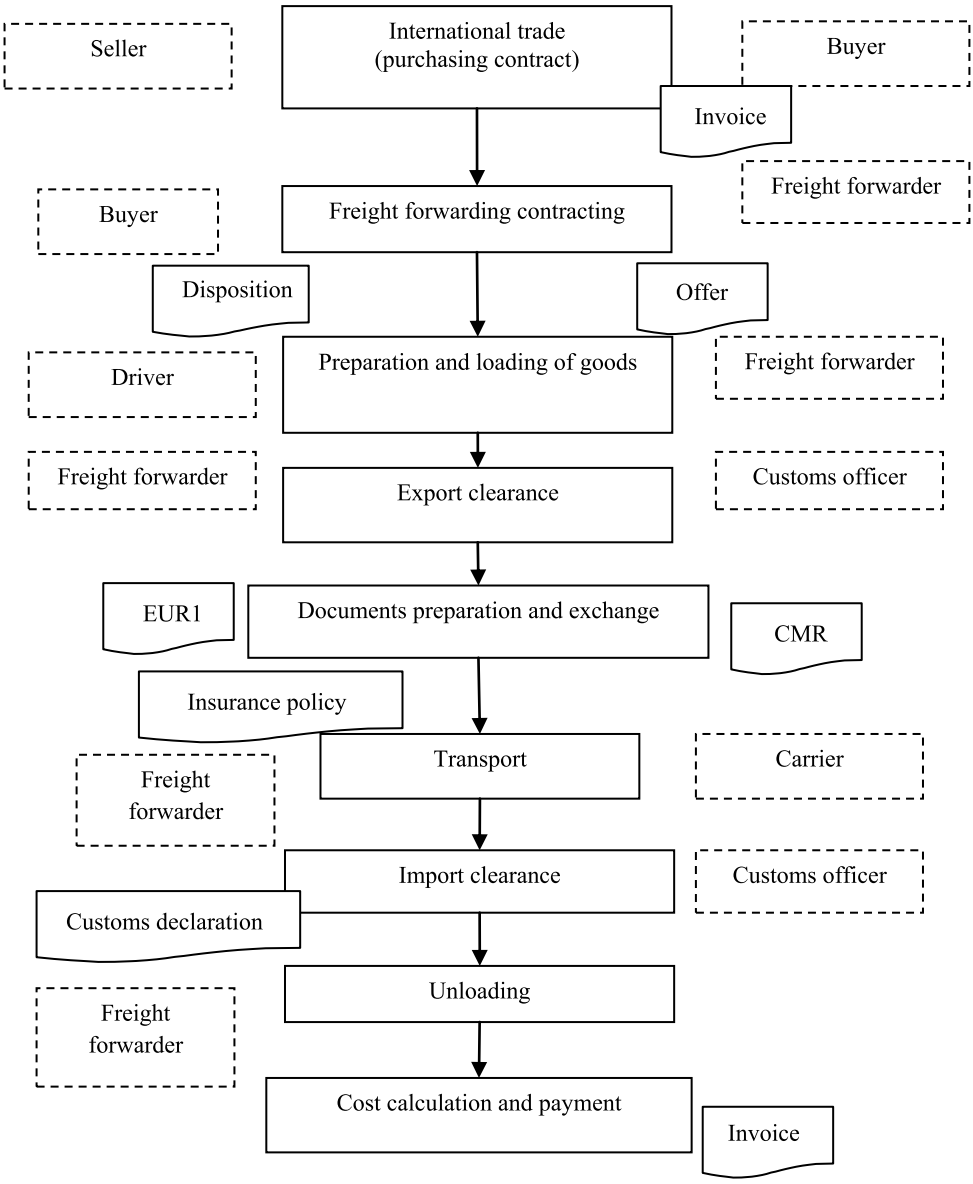

Fig. 1.
Basic Processes in Organization of International Flows

After the definition of transport mode, vehicles and route, the realization of transport can start. Preparation, packaging and loading of goods is the first step. Export clearance is the next step. Freight forwarder and customs officer realized mentioned process. Documentation preparation (CMR, EUR1, invoice, customs declaration, insurance policy, etc.) and exchange are very important for each flow. There are numerous potential risks and problems in this process. Failures in the documents filling can make problems in the following processes. For example, wrong address can cause problems in the delivery.

Transport is the next process in the organization of international flows. The risks and problems in transport are numerous: road congestion, malfunction vehicle, weather conditions, theft of goods, inappropriate packaging, inappropriate temperature, traffic accident, etc. Similarly in the process of import clearance a lot of potential risks exist like delay, congestion, documentation problems, problems with inspections, etc. After goods unloading processes of cost calculation and payment are realized.

3. FMEA – Usage and Basic Characteristics

FMEA is a technique for analyzing, defining, identifying, and removing potential problems and failures relating to the systems, processes or services before they arrive at the end user.

3.1. Literature Review

FMEA approach is used in air industry in the middle of the last century. This method has proven to be a useful and powerful tool in assessing potential failures as well as their prevention in many industries (Ravi Sankar and Prabhu, 2001). The main objective of the method is to identify potential failure modes, assess the causes and effects of different components, which could reduce or eliminate the chance of failure. Results can help analysts in the detection and correction of failures which have a negative impact on the system.

The FMEA method is widely used in many industries. It is used in the automotive, air, nuclear and chemical industries as well as in electrical engineering, mechanical engineering, medicine, etc. In the literature many authors used this method. Flores and Primo (2008) used FMEA for failure recovery process throughout the supply chain. Chang and Cheng (2010) combined FMEA approach with OWA (Ordered Weighted Averaging) and DEMATEL (Decision Making Trial and Evaluation Laboratory) approaches for overcoming traditional problems of determining RPN (Risk Priority Number). Proposed approach was tested in the manufacturing industry. The results show that using proposed approach has achieved greater precision in risk assessment. (Chin *et al.,* 2009a) stated that FMEA as a methodology is based on group decision making because there is always a team of experts. Team members often represent different opinions and possess different levels of knowledge, so the information in risk assessment are different, precise and inaccurate, complete and incomplete. There is a problem to include different information in the FMEA method using traditional RPN. They suggest the use of ER (Evidential Reasoning).

(Sharma *et al.,* 2005) proposed an approach that uses Fuzzy Logic to make the analysis more consistent and logical due to the subjective nature of the information. Proposed approach is tested in the paper

industry. The results show great applicability. Chiozza and Ponzetti (2009) described the main steps of the FMEA analysis in medicine. Guimaraes and Lapa (2007) use FRPN (Fuzzy Risk Priority Number) in FMEA approach in nuclear industry. Korayem and Iravani (2008) use FMEA method in the field of robotics. They combined FMEA and QFD (Quality Function Deployment) method. Andrejić and Kilibarda (2017) used FMEA approach for failure recovery in distribution logistics. For each of 36 identified distribution processes RPN number is calculated. Transportation, goods control (quantity, quality, expiration date, damage) and goods extraction and putting on pallets are identified as the most critical processes.

3.2. Failure Mode and Effects Analysis (FMEA) Approach

As mentioned before FMEA was developed for the failure analysis in different systems and processes. The procedure of this method is based on the failure characteristics and structure of observed systems and processes. The main objective of FMEA is to analyze potential defects/faults in the observed system and corrective measures that can reduce the risks. Benefits of failure detection are numerous: increasing the safety of functions and service reliability, reducing warranty and service costs, shortening the development process, better compliance of the planned terms, increasing process efficiency, increasing customer satisfaction, etc. FMEA discover and prioritize failures by computing risk priority number (RPN) which is a product of several risk factors: severity (S), occurrence (O) and detection (D) (Andrejić and Kilibarda, 2017). Severity describes the seriousness (effects) of the failure. Each effect is given a severity number from 1 (no danger) to 10 (critical). In this paper, severity ratings proposed in (Chin *et al.,* 2009b) are used (Table 1).

Table 1
Ratings for Severity of a Failure

Rating	Effect	Severity of Effect
10	Hazardous without warning	Very high severity ranking when a potential failure mode effects safe system operation without warning
9	Hazardous with warning	Very high severity ranking when a potential failure mode affects safe system operation with warning
8	Very high	System inoperable with destructive failure without compromising safety
7	High	System inoperable with equipment damage
6	Moderate	System inoperable with minor damage
5	Low	System inoperable without damage
4	Very low	System operable with significant degradation of performance
3	Minor	System operable with some degradation of performance
2	Very minor	System operable with minimal interference
1	None	No effect

Source: (Chin et al., 2009b)

Occurrence describes the probability of failure appearance. Traditional ratings for failure occurrence proposed in (Chin *et al.,* 2009b) are used in this paper (Table 2).

Table 2

Ratings for Occurrence (Probability) of a Failure

10	Very high: failure is almost inevitable	>1 in 2
9		1 in 3
8	High: repeated failures	1 in 8
7		1 in 20
6	Moderate: occasional failures	1 in 80
5		1 in 400
4		1 in 2000
3	Low: relatively few failures	1 in 15,000
2		1 in 150,000
1	Remote: failure is unlikely	<1 in 1,500,000

Source: (Chin et al., 2009b)

The ability to detect the failure before it reaches the customers can be defined as detection. The assigned detection number measures the risk that the failure will escape detection. A high detection number indicates that the chances are high that the failure will escape detection, or in other words, that the chances of detection are low (Ambekar *et al.,* 2013; Andrejić and Kilibarda, 2017). Detection ratings used in this paper are shown in Table 3.

Table 3

Ratings for Detection

Rating	Detection	Likelihood of Detection by Design Control
10	Absolute uncertainty	Design control cannot detect potential cause
9	Very remote	Very remote chance the design control will detect potential cause
8	Remote	Remote chance the design control will detect potential cause
7	Very low	Very low chance the design control will detect potential cause
6	Low	Low chance the design control will detect potential cause
5	Moderate	Moderate chance the design control will detect potential cause
4	Moderately high	Moderately high chance the design control will detect potential cause
3	High	High chance the design control will detect potential cause
2	Very high	Very high chance the design control will detect potential cause
1	Almost certain	Design control will detect potential cause

Source: (Chin et al., 2009b)

RPN is calculated after determination of three mentioned components. The RPN can be easily calculated by multiplying three mentioned components (eq. 1):

$$RPN = S \times O \times D \quad (1)$$

The failure modes with the highest RPN should have the highest priority for monitoring and corrective actions.

4. Risks Analysis in Organization of International Commodity Flows

In this section FMEA method is used for evaluation of risks in logistics processes in import flow. Organizing import commodity flow is a complex logistics job, which is realized under the influence of many external factors. Risks that accompany the organization of the import flow are numerous

and sometimes it is impossible to anticipate and manage them. As mentioned before risks and mistakes are present in all process shown in Figure 1. Failures can arise from human factors, machine and technical problems, weather conditions, or as a result of the current state of the market in a country.

The organization of each flow is specific and depends on the type of goods, route, customs procedures, etc. In this paper risks in import flow with general (common) processes mentioned in section 2 are analyzed in more detail. FMEA is applied for each process. As mentioned earlier for the successful implementation of this method, a group of experts is needed. In the process of identifying the importance of failures ten professionals and experts from the field of logistics and supply chains are involved. They are persons with specific knowledge and long-standing experience in organizing international commodity flows. Each of them rated three characteristics for all failures in individual processes. Their assessments were used as the basis for determining RPN numbers. Detailed analyzes is given below.

4.1. Preparation and Loading of Goods

The first process in the observed case is preparation and loading of goods. Eight dominant failures are identified as shown in Table 4. For each failure, its consequences are analyzed. Occurrence, severity and detection numbers are evaluated according ratings described in previous section. According RPN numbers for observed process the most important failure is wrong loading address.

The address of the factory is not the place where the goods is stored. Mentioned failure is the result of poor communication between importers and suppliers, as well as misunderstanding in the business of both parties. This occurrence is high, especially during the first purchase from a unknown supplier.

Production warehouse in some cases can be located nearby, so losses are less in such cases. However, it often happens that the warehouse is located hundreds of kilometers away from the address that is entered on the order. Therefore the truck travels the same distance twice, and therefore additional costs are doubled. These errors are rarely detected before the vehicle arrives at the wrong address, especially when the address of the loading found on the internet databases. Timely error detection can be prevented by contacting the supplier directly. The consequences are also time losses and penalties.

Table 4

Risks Analysis for Process of Preparation and Loading of Goods

Process	Failure	Consequence	O	S	D	RPN
Preparation and loading of goods	Delay due to retention on previous loading	Delay in delivery (out of term); Problems in customs procedures	8	4	8	256
	Wrong loading address (official and real address are different)	Empty driving - deadhead (unexpected cots)	9	8	9	**648**
		Time losses (delay - penalties)	9	9	9	**729**
	Inappropriate handling equipment	Manual loading; Engagement of third parties; time losses-delay with delivery	7	7	7	343
		Additional costs of engaging the vehicle	7	6	6	252
	Overload (the weight of the shipment exceeds the maximum load)	Problems with law	5	9	4	180
	Congestion on loading area	Time losses; Delay in delivery (out of term)	7	7	8	**392**
		Additional costs of engaging the vehicle	7	8	8	**448**
	Lack of reference / loading number	Problems with loading (inability)	5	4	7	140
	Inadequate manipulation of goods while loading	Damage to goods and unexpected cots	6	8	8	384
	Loading the wrong goods to the vehicle (returning the vehicle to the place of loading)	Empty driving - deadhead (unexpected cots)	6	6	8	288
		Time losses; Delays	5	8	8	320

According RPN numbers the next failure is congestion on the loading area. Congestion are common for large warehouse systems with large frequency. The importer is unable to predict congestion, because he do not know the operating procedures of foreign company. For that reason it is important to define terms of loading in advance. For transport companies the problem are unplanned delays. Failures with a smaller RPN number identified in observed example are: inappropriate handling equipment, overload, loading the wrong goods, lack of reference / loading number, etc.

4.2. Documents Preparation and Exchange

In the process of documents preparation and exchange the most important risk is taking incomplete documentation (Table 5). The problem usually occurs due to lack of time. This failure can also be caused by previous delays, which are often in practice. The consequences are: return to the place of loading due to the lack of documentation, empty drive, unexpected costs, etc. In order to overcome mentioned failure it is necessary to give additional instructions to the driver regarding the verification of documents. The driver need to inform freight forwarder when completes the document checking. The next risk relates to discrepancies in values and quantities in invoice, CMR and other documents. As a result of insufficient attention in the process of filling inconsistencies in the documents are appearing. Consequences are problems in customs procedures. The same consequences causes lack of stamps and signatures on the invoice.

Table 5

Risks Analysis for Process of Documents Preparation and Exchange

Process	Failure	Consequence	O	S	D	RPN
Documents preparation and exchange	Driver takes incomplete (unchecked) documentation	Return to the place of loading due to the lack of documentation (empty drive and unexpected costs)	8	7	8	**448**
	Lack of stamps and signatures on the invoice	Customs officer consider subject incomplete	7	9	6	378
	Discrepancies in values and quantities in invoice, CMR and other documents	Customs officer consider subject incomplete	7	9	7	**441**
	Lack of declaration of preferential origin of goods (for the value of goods <6000e	The importer is not exempt from paying import duties	6	8	7	336
		Time losses to the arrival of new (changed) invoice	6	8	7	336
	The supplier did not send the instructions/ documentation for creation of the EUR 1 form	The importer is not exempt from paying import duties	6	8	5	240
		Time losses for waiting instructions for creating EUR 1 form	6	7	5	210

4.3. Export Clearance

Communication among all participants is essential for the smooth organization of commodity flows (Table 6). Poor communication causes additional costs, time losses, in some cases damage and loss of goods, dissatisfaction of all participants, etc. Transporters, freight forwarders and logistics providers are not able to detect failures that have a direct impact on their operations. The task of a logistics provider is to contact the seller directly with the approval of the importer and try to get the necessary information, anticipate and solve the problem that directly threatens a certain trade flow.

Table 6

Risks Analysis for Process of Export Clearance

Process	Failure	Consequence	O	S	D	RPN
Export clearance	Lack of information - exact place of customs clearance	Additional km unexpected costs	7	9	8	**504**
	The customs procedure longer than 24 hours	Additional costs of engaging the vehicle	7	8	8	448
		Delay of delivery	7	8	8	448
	The supplier has not provided a service-the task assigned to the carrier; bad communication	Vehicle retention; Additional costs of engaging the vehicle	7	8	6	336
	Non-working day	Waiting for the first working day - additional costs of engaging the vehicle	4	8	5	160
	Documents authentication – forwarder error	Inability to leave the country; Time losses	6	8	9	432
	The freight forwarder does not prepare and does not send the EUR 1 - regardless he received the announcement	The importer is not exempt from paying import duties	6	7	7	294
		Import clearance is delayed – waiting for EUR 1; Additional costs of engaging the vehicle	6	8	7	336
	Bad communication seller-freight forwarder-importer	Delay of delivery	8	8	10	**640**
		Additional costs of engaging the vehicle	8	8	10	**640**

Lack of information is the result of poor communication. Changing the place of customs clearance may be an additional problem for the transporter. Additional costs and time losses are some of the potential consequences. The time spent driving the vehicle to a distant customs office and crossing the same distance twice, directly endangers the next loading as well as the arrival plan. Additional costs are usually paid by the importer. Regardless of the INCOTERMS (International Commercial Terms) rules, in some cases communication between supplier and freight forwarder is very important. According EXW rule export clearance is importer obligation, but freight forwarders often need instructions from the exporter. It often happens that some documents are missing or there are ambiguities. Timely and correct information is crucial in organizing commodity flows.

4.4. Transport

According Table 7 the most important risk in the process of transport is traffic congestion. Congestion on the road are frequent and it is not easy to predict and avoid them. In such situation clients are often dissatisfied and often intolerant because of the delays. In some cases delay of goods delivery can result in production stopping. The inability to detect or find alternative solutions is the core of this problem.

Table 7
Risks Analysis for Transport Process

Process	Failure	Consequence	O	S	D	RPN
Transport	Vehicle malfunction	Delay in delivery (out of term); penalties	6	9	9	486
	Traffic congestion		9	9	9	**729**
	Construction zone		7	6	6	252
	Inadequate infrastructure		6	6	5	180
	Bad weather conditions		6	8	6	288
	Traffic accident		6	7	10	420
	Congestion at the border		8	9	9	**648**
	Theft of goods	Unwanted costs and losses	6	8	6	288
	Poor security of goods in transport, damage to goods in transport	Unwanted costs and losses	7	8	7	392
	Inappropriate temperature	Damage to goods and unwanted costs	7	7	8	392
	Improper packaging; non palletized goods	Damage to goods and unwanted costs	7	8	8	448

Congestion on the border has similar consequences as previous failure. This failure is also impossible to anticipate and avoid. The potential solution is the choice of another border crossing. However, the vehicle is often conditioned to cross border in certain place defined in instructions of importer. In the case of holidays and previously non-working days, the congestion are additionally increased. In addition to the above mentioned, there are also the following risks: traffic accident, vehicle malfunction, damage to goods in transport, improper packaging, inappropriate temperature, etc.

4.5. Import Clearance

In the process of import clearance the most important failure is congestion in customs offices (Table 8). The delays in arrival of the vehicle to the customs office means the

impossibility of starting customs clearance procedure, so the clearance procedure is postponed for the next day. Defined terms of delivery cannot be realized in this case. Retention can be on loading, during the road, at the border, as well as in the customs office. The late arrival of the vehicle has a negative impact on all participants.

Table 8

Risks Analysis for Process of Import Clearance

Process	Failure	Consequence	O	S	D	RPN
Import clearance	Delayed arrivals	Delay in delivery (out of term)	8	8	7	**448**
	Congestion in customs offices	Delay in delivery (out of term)	9	9	8	**648**
	Freight forwarder failure in declaration filling	Vehicle retention at the customs office, delay in delivery	6	8	7	**336**
	The importer is not able to pay the customs duties; vehicle is captured	Additional costs of engaging the vehicle	6	3	7	126
		Delay in delivery (out of term)	6	3	7	126
	Customs officer consider subject incomplete	Delay in delivery (out of term)	7	3	9	189
	Lack of labor in providing freight forwarding services	Delay in delivery (out of term)	6	3	8	144
	Customs account delays	Inability to deliver on the same day - delays	7	3	9	189

In addition to the above mentioned, there are also the following risks: customs officer consider subject incomplete, lack of labor in providing freight forwarding services, the importer is not able to pay the customs duties, etc.

4.6. Unloading

As mentioned in the process of loading the dominant failure according RPN is wrong loading address (Table 9). The main problem it is not easy to detect this failure. The consequences are also time losses and penalties. The next failure in the process of unloading refers to vehicle arrival after working time. The consequences are postponing unloading for next day. Other failures (inappropriate handling equipment, inadequate manipulation of goods while loading and congestion on loading area) have less impact.

Table 9

Risks Analysis for Process of Unloading

Process	Failure	Consequence	O	S	D	RPN
Unloading	Wrong unloading address (official and real address are different)	Empty driving - deadhead (unexpected cots)	9	8	9	**648**
		Time losses (delay - penalties)	9	9	9	**729**
	Vehicle arrival after working time	Unloading is postponed for the next day; Vehicle retention	8	8	7	**448**
	Inappropriate handling equipment	Vehicle retention; Additional costs	7	7	6	294
	Inadequate manipulation of goods while loading	Damage to goods and unexpected cots	6	8	8	384
	Congestion on loading area	Vehicle retention; Additional costs	6	5	8	240

4.6. Cost Calculation and Payment

The process of calculating costs and payments is very important and it is necessary to pay enough attention to it, especially in the initial part. As shown in Table 10, the most common problem is inadequate calculation and anticipation of costs. The consequence is loss of revenue. Before contracting, it is necessary to check and evaluate the client. Problems with inability to charge of services can be overcome, by checking the client. Inappropriate banking services can cause problems in transfer and realization of payments.

Table 10
Risks Analysis for Process of Cost Calculation and Payment

Process	Failure	Consequence	O	S	D	RPN
Cost calculation and payment	Bad costs calculation and inappropriate offer	Income loss	8	8	7	448
	Bad anticipation of unexpected costs		9	9	7	**567**
	Inappropriate customer assessment	Inability to charge	7	8	8	448
	Inappropriate banking service	Problems in transfer and realization of payments	6	7	7	294

5. Conclusions

The organization of international commodity flows is a complex and highly responsible process. A large number of participants and activities need to be coordinated and organized, so that there is no congestion or delays. The main processes identified in this paper are: preparation and loading of goods, export clearance, documents preparation and exchange, transport, import clearance, unloading, cost calculation and payment. Seller, importer, freight forwarder, transport company and customs officers are identified as the main executors and participants.

In this paper, for risk analysis FMEA approach is used. The FMEA method provides the basis for failure management. Each process is characterized by certain failures. According results the most important failures in the process of loading and goods preparation are wrong loading address and congestion on loading area. There are different failures in the process documents preparation and exchange. According FMEA numbers the most important are incomplete (unchecked) documentation taking and discrepancies in values and quantities in invoice, CMR and other documents. Bad communication and lack of information are the main problems in the process of export clearance. Traffic congestion and congestions on the border are the most important problems in the transport process. Mentioned failures are main reasons of delays in transport. Process of import clearance is characterized by different failures. The most influential are congestion in customs offices, delayed arrivals and failures in declaration filling. As in the loading process, wrong address is also the most important problem in the unloading process. Bad anticipation of unexpected costs and inappropriate offer may causes loss of revenue.

FMEA method proved to be extremely useful method for failure evaluation in logistics. In

future research it is necessary to combine the FMEA method with other approaches in order to obtain better solutions. It is also necessary to explore in more detail the possibilities of preventive action and reduction of errors in logistics processes. The collection and analysis of real data from various logistic systems is the basis for the development of new models and approaches to the management of risks and failures in logistics.

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References

Ambekar, S. B.; Edlabadkar, A.; Shrouty V. 2013. A review: Implementation of Failure Mode and Effects Analysis, *International Journal Engineering and Innovative Technology* 2 (8): 37-41.

Andrejić, M.; Kilibarda, M. 2017. Failure management in distribution logistics applying FMEA approach. In *Proceedings of the 3rd International Logistics conference*, 25-27 May, Belgrade, Serbia, 148-153.

Chang, K. H.; Cheng, C. H.; Chang, Y. C. 2010. Reprioritization of failures in a silane supply system using an intuitionistic fuzzy set ranking technique, *Soft Computing* 14(3): 285–298.

Chin, K. S.; Wang, Y. M.; Poon, G. K. K.; Yang, J. B. 2009a. Failure mode and effects analysis using a group-based evidential reasoning approach, *Computers & Operations Research* 36 (6): 1768–1779.

Chin, K. S.; Wang, Y. M; Poon, G. K. K.; Yang, J. B. 2009b. Failure mode and effects analysis by data envelopment analysis, *Decision Support Systems* 48 (1): 246–256.

Chiozza M. L.; Ponzetti C. 2009. FMEA: A model for reducing medical errors, *Clinica Chimica Acta* 404 (1): 75-78.

Flores, L. A. F. S.; Primo M. A. M. 2008. Failure Recovery Management in Performance of Logistics Services in a B2B Context: A Case Study Using the 3PL Perspective, *Journal of Operations and Supply Chain Management* 1(1): 29-40.

Guimaraes, A. C. F.; Lapa, C. M. F. 2007. Fuzzy inference to risk assessment on nuclear engineering systems, *Applied soft computing* 7(1): 17-28.

Kilibarda, M.; Andrejić, M. 2017. Efficiency of logistics processes in customs procedures. In *Proceedings of the 3rd International Logistics conference*, 25-27 May, Belgrade, Serbia, 154-159.

Korayem, M. H.; Iravani, A. 2008. Improvement of 3P and 6R mechanical robots reliability and quality applying FMEA and QFD approaches, *Robotics and Computer-Integrated Manufacturing* 24(3): 472-487.

Kilibarda, M.; Nikoličić, S.; Andrejić, M. 2016. Measurement of logistics service quality in freight forwarding companies: a case study of the Serbian market, *The International Journal of Logistics Management* 27(3): 770 - 794.

Ravi Sankar, N.; Prabhu, B. S. 2001. Modified approach for prioritization of failures in a system failure mode and effects analysis, *International Journal of Quality & Reliability Management* 18 (3): 324–336.

Sharma, R. K.; Kumar, D.; Kumar, P. 2005. Systematic failure mode effect analysis (FMEA) using fuzzy linguistic modeling, *International Journal of Quality & Reliability Management* 22 (9): 986–1004.

Zamora-Torres, A. I.; Navarro-Chavez, C.; Pedraza-Rendon, O. H. 2013. The Impact in Customs Efficiency of the ITSW: Mexico Case of Study, *i Business* 5 (02): 1-6.