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Managing the Causes of Delay in General Cargo Handling Operation

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ABSTRACT

The present research has been conducted to identify and prioritize the inveterate Causes of delay creation in general cargoloading/unloading operation in Port of Amirabad(NORTH OF IRAN)by use of FMEA model. For the purpose of this research, the daily census of lag and halt in loading/unloading operation in the mentioned cases and their relevant causes during a specific period were studied. As well, brain storming cessions attended by experts from the mentioned terminals were held during which twenty three numbers of causes of delay in L/U operation were identified. The identified main factors with their pertinent scores have been prioritized as deficiency and malfunction of quay vertical transportation equipment (486), deficiency and malfunction of quay horizontal transportation equipment (486), improper stowage of goods (448), Improper packing of goods (448), Unpreparedness (432) Financial and administrative matters (420). Based on the obtained results, technical deficiency and malfunction of quay horizontal and vertical transportation equipments possess the highest number of risk priority while Financial and administrative matters has the least number.
KEYWORDS: general cargo, Port of Amirabad, Efficiency, FMEA model.

1. INTRODUCTION

Expansion of transportation industry is one of the important indicators of economic development of nations. Nowadays, the influence of transportation on sustainable development is pretty vivid and undeniable [1].This sector includes economic activities which are widely effective in all categories of production, distribution, consumption and services[2, 3, 4]. Through the advantages such as low cost for high volume of cargo shipment, marine transportation as one of the important bases of this industry plays an essential role in development of nations' foreign trade[5, 6, 7] Because of special geographic location and accessibility to free waters, Iran has a particular situation in marine transportation industry. Ports as a significant component of marine transportation system[8, 9].are one of the rings of global supply chain [10, 11, 12]. Since time and cost are considered as the important factors of competition in the present world, service complexes which are considered by economists, traders and producers as the infrastructures of global trade, undertake a significant role in optimization of transportation costs and distribution of goods[12, 13, 14] In other words, those companies are successful in their job who can deliver their goods duly to their customers with a lower cost[15, 16]. Therefore owners wish to expedite passing their goods from ports and decrease transportation tariffs and costs [15]. That's why the extent of ports efficiency has an effective role in realization of their wants. Efficiency of ports can have a remarkable influence on decreasing the period of ships stay in ports, goods sedimentation period and reduction of the freight taken by shipping companies. Therefore ports efficiency can result in satisfaction of customers, increase of demand level and more profitability. So optimization of ports loading/unloading operation (hereinafter referred to as L/U operation) is considered as an important approach to decrease the period of transmission of goods from producer to consumer. Taking into consideration the importance of this approach for improvement of ports performance, fulfillment of studies on ports performance - as the country's main gates of international trade – appears to be more important than before.

The considering necessity of ports L/U operation optimization, The present research has been conducted to identify and prioritize the inveterate Causes of delay creation in general cargo loading/unloading operation in Port of Amirabad (NORTH OF IRAN) by use of FMEA model which is one of the most accurate and updated methods of studying performance and efficiency of systems.

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Research Record

Ports Performance Evaluation Methods

Researchers apply various methods to study and measure the performance of organizations in view points of efficiency and productivity. DEA[1]is one of the common methods which evaluate the relation between inputs and outputs by use of production function. This method is based on a series of optimization models of linear programming for measuring the relative efficiency in similar units. In this method, the efficient frontier curveis arisen from a series of points determined by linear programming model. After implementing optimization model, the linear programming method specifies whether the intended decision making unit is located on the efficiency border or outside. In this way the efficient and inefficient units become separated. For example Cullinane and others [17]compared Data Envelopment Analysis and Stochastic Frontier Analysis to estimate the technical efficiency of container ports. The objective of this research is to study strength and weakness points of these two methods. The total length of quay, terminal area, the number of Quayside cranes, the number of gantry cranes of port area, the number of straddle carriers are regarded as the inputs of the research model. On the other hand, container efficiency or operational poweras a very important and peerless indicator has been considered in the model output. The study has been accomplished on 57 numbers of contain erports or their existing terminals. Hung and others[18]conducted a comparative study on evaluation of operational efficiency of Asian container ports by application of data envelopment analysis. Al-Iraqi and others[19].Evaluated the efficiency of 22 ports in Middle East and Eastern Africa by use of data envelopment analysis. The case studies of their research includes ports from Sudan, Eritrea, Djibouti, Kenya of Eastern Africa and ports from Saudi Arabia, Yemen, Oman, UAE and Iran from Middle East. The statistical period under the study is from 2000 to 2005. Tongzon [20]discusses the existence of errors in researches of some organizations on the influence of portion of factors impacting on estimation of port efficiency and performance. To fill this gap he offers a model by the factors affecting port efficiency and performance. In this model, he measures the performance of port based on the number of transferred containers through the port (or operational power) provided that the operational power of port is maximum. He believes factors such as geographic location, the number of ships' recourses to the port, port costs, level of economic activity and efficiency of terminal determine the port efficiency or port operational power. He thinks that the efficiency of ports is under the influence of container size (20 or 40 –foot size), working procedures, cranes efficiency and tonnage of entering ships.

MATERIALS AND METHODS

The present case studies the causes of lag and halt in L/U operation in Port of Amirabad general cargo terminal. To achieve this objective, the daily censuses of Port of Amirabad including the extent of halts and lags in L/U operation with their pertinent causes as well as the census of Port of Amirabad incoming vessels in the period of 21st March, 2011 to 21th November 2011 have been applied [21].

Failure Mode and Effect Analysis (FMEA)

McDermott[22]believe that by using such an efficient tool, the potential modes of failure in system, process, product and services can be identified and prioritized, as well, the necessary measures to remove or decrease the extent of potential modes of failure can be defined and determined. They introduce FMEA as a key tool for improvement of safety, promotion of quality and attraction of customer satisfaction. FMEA has been defined in educational material of automobile manufacturing companies as below:

FMEA is a series of systematic activities with the following objectives:

Identification and evaluation of potential failures existing in design of system, product and process as well as estimation of occurrence of each one of them [23, 24]

- Identification of measures which can decrease or remove the probability of occurrence of probable failures
- Identification and taking the measures by which the extent of consequent intensity and tenseness of errors may be decreased as much as possible
- Identification and taking the measures by which the ability of recognition or probability of unveiling the errors can be increased before reaching to the customers
- Documentation of the processes

The FMEA has two overall goals; one short term and one long term. The short term goal is to reduce the failures as much as possible and the long term goal is to eliminate all failures. Having that said the costs of reduction/elimination should of course also be considered. At one point in time the cost of reducing a failure mode further will probably be higher than the benefit of doing so. Beside that the rest of the organization should also be

[1] Data Envelopment Analysis

considered when evaluating what is most important; to do a FMEA over again or maybe to do another risk assessment with a new focus [25, 26]

One of the best features of FMEA is taking proactive instead of reactive measure in facing the failures [27]In other word, the method focuses on taking proactive measure before occurrence of the accidents. Because in case of occurrence of a burdensome accident, normally enormous charges shall be spent to offset the created difficulties and failures while if, for any reason, an error happens in designing stage, the extent of the coming damage will be maximized because a variation in designing will cause variations in production tools, costs of product and process redesigning. Features such as reduction of repeated works and corrective steps, quality improvement, increase of assurance capability, increase of safety and reduction of the needed time for deliverance of product to customer are the other features of FMEA[22]. Therefore FMEA can be deemed as one of the tools of continuous quality improvement of goods and services in companies. Risk analysis in FMEA table is done through determination of probability of error modes occurrence (occurrence frequency), the extent of its effect on post occurrence process (severity) and probability of its identification before influencing the process (detection). Each one of these cases would be scored by some experts in a scale from 1 to 10. The number 10 shows the most unpleasant influence on the process. These three ranks are multiplied by each other and constitute the number of risk priority presented in acronym form of RPN[2][27, 24]. Cases with higher extent of RPN attract higher priority in improvement process.

The present research has been implemented via FMEA in the following stages:

First Stage

In this stage In the first stage, the census of lag and halt in loading/unloading operation in the mentioned cases and their relevant causes during a specific period were studied. As well, brain storming cessions attended by experts from the mentioned terminals were held during which twenty three numbers of causes of delay in L/U operation were identified.

Second Stage

In this stage the going controls for each one of the failure modes are identified. The obtained results of this stage have been mentioned in table 1.

Third Stage

The last stage of the process is L/U risk analysis. The score of risk priority is obtained by multiplication of three numbers belonging to severity, occurrence and identification of error modes by which the analysis of process risks and prioritization of steps for efficiency promotion can be practiced. The number of severity, occurrence and identification of error modes of L/U process are estimated by use of tables 2, 3 and 4. Table 5 analyzes the failure modes and effects of L/U process and determines risk priority number of this process.

Table 2 – Ranking the extent of error severity in L/U operation [28]

Criterion: Severity of Effect on Loading/Unloading Process	Effect and result of failure	Rank
Halt duration of operation is more than 24 hours.	Very much delays	10
Halt duration of operation is more than 12 and less than 24 hours.	much delays	9
Halt duration of operation is more than 12 and less than 6 hours.	Average delays	8
Halt duration of operation is less than 6 or lag duration of operation is more than 18 hours.		7
Lag duration of operation is less than 18 and more than 12 hours.		6
Lag duration of operation is less than 12 and more than 6 hours.	Little delays	5
Lag duration of operation is less than 6 and more than 3 hours.		4
Lag duration of operation is less than 3 and more than 2 hours.	Very little delays	3
Lag duration of operation is less than 2 hours.		2
There is no halt or lag in operation.	No delay	1

Table 4 – Ranking the extent of error occurrence in L/U operation [28]

Criterion: Extent of error occurrence	Failure occurrence probability	Ranking
More than 36 percent	Very high And High	10
30 – 36 percent		9
24 – 30 percent		8
18 – 24 percent		7
12 – 18 percent	Average	6
6 – 12 percent		5
3 – 6 percent		4
1.5 – 3 percent	Low	3
Less than 1.5 percent		2
Error mode has been controlled via predictive measures.	Very low	1

[2]Risk Priority Number

Table 5 – Ranking the extent of error identification probability in L/U operation [28]

Criterion of Error Identification Probability	Probability of Identification	Rank
Controls cannot certainly identify error.	Very improbable	10
Deficiency is identifiable after operation but process factors cannot correct it.	Very tiny probability	9
Process factors can limitedly do corrections after error occurrence.	Very low probability	8
Process factors can correct errors after operation.	Low probability	7
Process factors can correct errors while operation.	Below average probability	6
Controls have average effectiveness for error identification.	Average probability	5
Error is identifiable before operation.	Above average probability	4
Controls have high effectiveness for error identification before operation.	High probability	3
Controls are very highly probable for errors identification before operation.	Very high probability	2
Controls can identify and correct errors with a high confidence.	Almost probable	1

Table 6 – Analysis of error modes and effects and risk priority number

Number	Components and function	Error modes	Error effects	Severity	Error Cause	Occurrence	Current Controls for Identification	Identification	Risk Priority Number
1	Goods owner, receiving from and delivering goods to port	Unpreparedness of factors outside the port for receiving or delivering goods	Halt of L/U operation of goods	7	Financial and administrative matters	6	There is no specific control	10	420
2				6	Unpreparedness	8	There is no specific control	9	432
3			Lag of L/U operation	6	Financial and administrative matters	6	There is no specific control	10	360
4				8	Improper packing of goods	7	Training policy	8	448
5				5	Smuggled goods	8	Psc cooperation with Customs Administration	10	400
6				5	Shortage of trucks	6	There is no specific control	9	270
7	Port, goods transmission between ship and coast vice versa	Unpreparedness of port for L/U operation of goods	Halt of L/U operation	8	Ship pass and quarantine formalities	7	Coordination among relevant organizations by Port administration	7	392
8			Lag of L/U operation	9	Deficiency of vertical transportation equipment	6	Implementation of repair programs and accomplishment of predictive repairs	9	486
9				9	Deficiency of L/U horizontal equipment	6	Implementation of repair programs and accomplishment of predictive repairs	9	486
10				8	Quay traffic	7	Modification and improvement of input/out put models	6	336
11				5	Inelasticity of container yard	7	Control by port	8	280
12				6	Delay in start and early finish	5	Control by port operation department	6	180
13				2	Unpreparedness of relevant contractor	7	Control by port operation and statistical processes	7	98
14				4	Labor matters	6	Supervision by the heads of workgroups	5	120
15				3	Pass and quarantine formalities	10	Coordination among relevant organizations by Port administration	6	180
16	Ship, transporting goods to port and transmission of goods from port	Unpreparedness of ship	Halt in L/U operation	4	Confiscation by PSC	10	PSC and Port administration	8	320
17			Lag of L/U operation	9	Deficiency of ship equipments	4	There is no specific control	3	108
18				4	Adjusting the balance of Ship	6	Training policy	6	144
19				7	Improper stowage of goods	8	There is no specific control	8	448
20	Other factors	Creation of turbulence in L/U work	Halt of L/U operation	4	Foul weather and tide prediction	4	Application of weather forecast reports to take preventive measures	7	392
21			Lag of L/U operation	10	Foul weather and tide prediction	3	Application of weather forecast reports to take preventive measures	3	90
22				5	Official and public holidays	7	Control and pursuance with consideration of national official calendar	3	105

RESULTS

Aimed to identify and prioritize the causes of halt and lag inPort of Amirabad general cargo L/U operation, the present research has been conducted by use of Failure Mode and Effect Analysis method. The research was accomplished in seven stages during which themain causes of lag and halt creation in L/U operation were studied. The identified main factors of halt and lag creation and their risk priority numbers are as follows respectively: deficiency and malfunction of quay vertical transportation equipment (486), deficiency and malfunction of quay horizontal transportation equipment (486), improper stowage of goods (448), Improper packing of goods (448), Unpreparedness (432) Financial and administrative matters (420). And also abstained result show that the following causes respectively have minor effect on halt and lag in Port of Amirabad general cargo L/U operation:Foul weather and tide prediction (90), Unpreparedness of relevant contractor (98), Official and public holidays (105), Deficiency of ship equipments (108), Labor matters (120). Thus deficiency and malfunction of quay vertical and horizontal transportation equipments and deficiency and malfunction of quay vertical transportation equipment scored the highest risk priority number while Foul weather and tide prediction scored the least number.

As well, taking into consideration the number of occurrence of causes of error modes, it can be a good scale for judging the current controls in L/U process. In other words, the extent of error modes occurrence shows the important matter that the current controls in domain of prevention of error modes have acted so weakly and in most of the cases there had been no control.

DISCUSSION AND CONCLUSION

Applying FMEA method, the present research studied the main causes of creation of halt and lag in L/U operation. Based on the risk priority numbers, deficiency and malfunction of quay vertical transportation equipment, deficiency and malfunction of quay horizontal transportation equipment, improper stowage of goods, Improper packing of goods, Unpreparedness, Financial and administrative matters. have been identified as important factors of creation of delay in general cargo L/U operation in Port of Amirabad.

Considering the current operational trend in Port of Amirabad, the followings are suggested to reduce delays in general cargo L/U operation:

- Deficiency and malfunction of quay vertical and horizontal transportation equipments: fulfillment of periodic inspections, repair and maintenance according to manufacturers' standards, purchasing new equipments, making the depreciated and old equipments out of service and providing spare equipments for emergency events can to a large extent remove the existing problems.
- Unpreparedness of factors outside the port including owners of goods and agents of shipping lines: as these factors are not directly under the control of port, their control is very difficult and complicated. Owners have to take all required measures to make their agents prepared for implementation of L/U operation and start the operation upon ship berthing to jetty. In those transportation contracts in which L/U is the duty of owner, he is bound to supply the necessary equipments for the work. Obviously, if an incompetency happens in work, a halt will rise in the L/U operation. To remove this deficiency, it is better BIK managers pay more attention to encourage and employ more qualified contractor companies of L/U operation to offer proper equipment and workforce to the owners. Also, they have to build an appropriate structure to makeprompt and easy communication with companies and owners.

REFERENCES

[1] Castillo-Manzano, J. I., C. N., Mercedes, F., Gonzalez Laxe, L., Lopez-Valpuesta, and M. T., Arevalo-Quijada, 2009. Low-Cost Port Competitiveness Index: Implementation in the Spanish Port System. Marine Policy, (33): 591-598.

[2] Slack, B., 2009. Containerization, int.er-port Competition, and Port Selection. Maritime Policy and Management, 12(4): 293-303.

[3] Malchow, M., and A., Kanafani, 2008. A Disaggregate Analysis of Factors Influencing Port Selection. Maritime Policy and Management, 28(3): 265-277.

[4] Malchow, M. B., and A., Kanafani, 2004. A Disaggregate Analysis of Port Selection. Transportation Research Part E, 40: 317-337.

[5] Bichou, K. and R., Gray, 2005. A critical review of conventional terminology for classifying seaports. Transportation Research A, 39(1): 75-92.24.

[6] Notteboom, T.E., and J.P., Rodrigue, 2005. Port regionalization: towards a new phase in port development. Maritime Policy and Management, (6): 297–313.

[7] Pallis, A.A. and. T.K., Vitsounis, 2009. Port performance: Measuring port users perspectives. Critical Issues in the Port and Maritime Sector, University of Antwerp.

[8] Murphy, P., J., Daley, and D., Dalenberg, 1992. Port Selection Criteria: An Application of a Transportation Research Framework. Logistics and Transportation Review, 28(3): 237-255.

[9] Brooks, M.R. and A. A., Pallis, 2008. Assessing port governance models: Process and performance components. Maritime Policy and Management, 35(4): 411-432.

[10] Brooks, M.R., and K., Cullinane, 2007. Port Governance and Performance, Elsevier. London, UK.

[11] Pallis, A.A., and T.K., Vitsounis, 2008. Towards an alternative measurement of port performance: Externally generated information and Users satisfaction, International Forum on Shipping. Ports and Airports (IFSPA) (proceedings: CD-Rom), Hong Kong.

[12] Murphy, P.R., and J.M., Daley, 1994. A Comparative Analysis of Port Selection Factors. Transportation Journal, 34(1): 15–21.

[13] Ha, M.S., 2003. A Comparison of Service Quality at Major Container Ports: Implications for Korean Ports. Journal of Transport Geography, 11: 131-137.

[14] Jagerman, D., and T., Altiok, 2003.Vessel Arrival Process and Queuing in Marine Ports Handling Bulk Materials.Queuing Systems, 45: 223–243.

[15] Marianosi, N.S., M.A., Lambrou, and D., Spyrou, 2010. An integrated methodology for evaluating electronic port services for container terminals: the OLP case. Department of Shipping Trade and Transport, University of the Aegean.

[16] Robinson, R., 2002. Ports as elements in value-driven chain systems: the new paradigm. International Journal of Maritime Policy and Management, vol. 29(3): 241-255.

[17] Cullinane, K., T. F., Wang, and D. W., Song, P., Ji, 2006. The Technical Efficiency of Container Ports: Comparing Data Envelopment Analysis and Stochastic Frontier Analysis. Transportation Research Part A, 40: 354-374.

[18] Hung, S. W., W. M., Lu, and T. P., Wang, 2010. Benchmarking The Operating Efficiency of Asia Container Ports. European Journal of Operational Research, (203): 706-713.

[19] Al-Eraqi, A. S., A., Mustafa, and A. T., Khader, 2010. An Extended DEA Windows Analysis: Middle East and East African Seaports. Journal of Economic Studies, (37): 208-218.

[20] Tongzon, J. L., 1995. Determinants of Port Performance and Efficiency. Transportation Research Part A, 29 (3): 245-252.

[21] Operation Census Official Site. 2011. Census Administration of Ports and Maritime Organization, www.pmo.ir.

[22] McDermott, R. E., R. J., Mikulak, and M. R., Beauregard, 2009. The Basics of FMEA.CRC Press, USA.

[23] Pearson, R., 1980. Containerline Performance and Service Quality.University of Liverpool.

[24] EmamiMeibodi, 2005. Principles of Efficiency and Productivity Evaluation.Commercial Research and Studies Institute, Tehran.

[25] Branch, A. E. 2008. Elements of Shipping. London and New York, Routledge Taylor and Francis Group, Pp: 123–155.

[26] Foster, T. A., 1979. What's Important in a Port, Distribution World Wide, pp. 32-36.

[27] Karbasian, M. A. Aqadadi, 2006, Six Sigma and Quality Costs. ArkaneDanesh and DaneshPazhoohaneBarin Press, Isfahan.

[28] Jafari, H., 2011, Increasing Efficiency rate of Container Loading/Unloading Operation in BIK by Use of 6 Sigma Method. BS Thesis, marine Economics and Management, khoramshahr Maritime Sciences and Technologies.