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Designing MRP Model in the Condition of Capacity Constraints and Variability of Delivery for Critical Items in ABC Inventory Model "Case Study in National Company of South's Oil-rich"

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Abstract

In productive enterprises, timely preparation and procurement of goods is very important due to that related costs to the production and working capitals of organization is severely affected. In available scientific methods, including MRP, regardless of resource constraints and other factors, the amount of lead time of goods has always considered to be fixed. In this paper, then a model will present that lead time of goods is considered as dynamic by using statistical and also effectiveness models from internal and external environment variables of organization and optimized the cost of production in order to reduce the latency in timely receiving and balancing the warehousing time. At the end, researcher with the implementation of issue in a simulated environment and compare it with the real environment, shows the advantage of proposed model compared to other models by numbers and figures.

Keywords: MRP; Lead time of goods; ABC; the latency in timely receiving; Warehousing time

Introduction

What is today in great importance for managers of large enterprises and organizations is that be able to preserve their dynamics in decision-making and short and long-term planning and improve the organization's and surpass in the competitive world and put the development as the policy of their activities. So, use of tools that determines the result of activities performance by using scientific methods is important in decision-making and lead organization. Should be mentioned that today, more than 90% of working capital is often related to the manufacturing industry of materials and goods.

And from the time was felt that increasing cost of interest on existing capital threaten the survival, growth and development of industries, attention to warehouse management especially in large production industries increased since that today is considered as one of the most important parts of high-ranking management in leading manufacturing industries [1]. So, that, lead goods and needs of an organization, its maintenance and necessary financial and sexual control about them is considered as one of the most important tasks of the agencies, especially in manufacturing organizations. In this context, "Logistics Management" or the administration of "warehouse" that encompasses mentioned operation, is one of the most valuable specialty of management. This specialty in level of organization is firm and exalted and has an important contribution to organizational goals and Increasing the efficiency and profits. Because, on the one hand a large part of organization's working capital be spent for purchasing goods and different materials, which may be exposed to waste and nothingness due to improper warehousing and mismanagement (Every year are witness for millions of monetary unit losses in this field in different organizations). On the other hand, unfortunately, the most exploits and the highest percentage of administrative and financial corruption lies in this field of management [2]. In order to avoid these risks and to prevent such damages, use and exploit of advanced purchasing and warehousing systems and applying proper management of goods and materials is inevitable [3,4].

Materials requirements planning method is one of these scientific methods that can help organization by providing a pattern for the management of critical items that is identified by ABC inventory control models.

Problem Statement

One of the necessities of survival, development and reconstruction of industrial, commercial and services organizations, are appropriate management and consequently efficient planning. Regardless of the planning and management an organization's survival can never be guaranteed. In this regard, production and inventory management has an important role in precise planning of supply of materials and goods to produce the final product. Lack of proper control of inventory can cause problems in production system. These inventories play a strategic and crucial role in any production or services systems and with its proper planning and control can moves through making balance of operation, because inventory control, eliminate the problem of synchronization of production and consumption. On the other hand, Warehouse costs is including the costs of ordering, maintenance and goods deficit and also, warehouse management of each organization is obliged to control these costs.

National company's oil-rich south as one of the largest manufacturing companies in Iran and the world with the responsibility of producing more than three million barrels per day,

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for the preservation and maintenance of tanks and oil-gas fields and development of production and productivity of new oil-gas field and technologies and send materials to refining centers in Iran and principles export of gas injection and oil-gas pipelines to transfer recycled materials to manufacturers is responsible for exploitation of the oil/gas and LPG and therefore selecting a lead method, to provide timely needed industrial goods are from requirements of this massive company that is lonely provider of more than 80% exchange income of county. This company had to adopt scientific methods to increasing the ensuring level of timely supply of needed goods and decreasing the maintenance costs of goods simultaneously [1]. That mentioned goods has potential importance of financial (Materials and excavation goods for the purposes of developing oil and gas fields, spare parts and other consumables for repairs and maintenance of machinery and devices, in order to continuity the process of exploitation of oil and gas reservoirs and prevention of possible interruptions in production) and on the other hand the number, frequency and time of the order, time distance of providing each items, type and the storage number of different goods and circulation rate of each goods item are also important parameters that has an important role in providing timely goods [5,6]. For this purpose, in order to excavation goods in terms of being expensive and damages caused by lack or deficiency at the required time a large amount of money is spent that ABC inventory control is of potential importance [7].

If purchased goods be kept for a short time, warehousing costs will be negligible but despite being economical of purchase goods in large sizes, warehouse costs will be increases and in addition, costs for the stagnant of capital, corruption of surplus goods on consumption, goods obsolescence and others will be imposed on company [8]. Then, the main purpose of higher management of company should be such a way that totally, minimizes the operation costs that mentioned total is affected by what products should order and provide and also the time and amount of orders should be specified.

Considering that, shortage or lack of goods in proper time causes damage in the process of production and make an irreparable damage, it is necessary to adopted a policy in order to prevent possible damages, so by using scientific methods and use of technology prevents some events in addition to providing timely goods in order to meet the needs and current operational necessity that will lead to irreparable damage [9].

Warehouse inventory in national company's activities of South's oil-rich is very important. Lack of proper control of inventory can cause problems in production system [10]. These inventories play a strategic and crucial role in any production or services systems and with its proper planning and control can moves through making balance of operation, because inventory control, eliminate the problem of synchronization of production and consumption. On the other hand, Warehouse costs is including the costs of ordering, maintenance and goods deficit and also, warehouse management of each organization is obliged to control these costs. To avoid problems and possible damages caused by lack of inventory items, must be use techniques that eliminate the possibility of making any kind of problems in the production environment or as possible to reduce its occurrence [11]. ABC analysis is one of the most efficient techniques that are used in organizations. This classification is including three groups (A, B, C), that Class A items have the highest value and class C with the lowest value. In ABC analysis, only pay attention to criteria of price and number in period. While, taking into account that other qualitative factors such as amount of criticality of items, time period of purchase and the rate of abandonments could be useful for the classification of warehouse items. Thus, the combination of ABC classification with other techniques lead to consider qualitative factors in the use of these techniques. According to material presented in this paper attempts to design a model that MRP is presented in the condition of capacity constraints with regard to the variability of delivery for crisis items by using ABC inventory model.

Research Mathematical Model (Comparative Models for Production Control)

Ordering goods based on needed times for goods on a project, is fundamentally important. Project analysis information before its implementation is set in the hands of experts and project engineers and needed materials and goods planning for the project is begins before its implementation. Since the delay in receiving the goods can lead to slowing down the implementation of the project and increasing the corresponding costs, Therefore, optimality of order 's time indicates its importance in this matter [12,13]. Although predicted to achieve an ideal time to order different items of goods on a project is virtually impossible matter, but one of the goals of this model will be that with the desire to delay limit to zero, time order is close to real-time of receive the goods. In mathematical terms, if shows the delay time with *t(w)* and order time with *LT* and receive real time with ALT, in this case, the first goal of the model is shown below.

$$\lim t(w) \to 0 LT = ALT$$

Time delay in receiving the goods is critical so that many programs for various reasons known and unknown, and various problems and ultimately delay in receiving the goods actually lose their economic justification and lead to extortionate costs. South purposes of this model was to deal with such circumstances. Order time dynamics in this model has always been considered the mentioned issues and problems in goods order indirectly, as with registration of changes of real order time or ALT, made this model compatible with the new entered changes and causes dynamics of order time [14]. Like that by registering fluctuations of receipt of goods, various known and unknown status information will be recorded in this model.

Important Note

One of the solutions which immediately clear in the minds of anyone is that it is better to orders all items firstly and ensure to its receipt, take action toward implementation of programs and in fact, after receiving all items and making sure, starts the implementation of the project [4,11].

In this case, it should be noted that, the second purpose of this model is preventing of goods accumulation in the warehouse. Sound and rational management of project funds, always forbids the accumulation of goods in the warehouse. The purpose of goods accumulation in the warehouse (fat warehouse) is that initially, all goods and needed materials for the project, order, and keep in warehouse and then run the project so that we do not face never delayed receipt of the goods (Or time of storage of goods be more than usual). Of course, this is not an optimal method and as mentioned before, is in contrast with appropriate management of project, Because the majority of project's capital used to buy and maintenance of project's goods and this is not correct. Moreover, this technology changes affect the conditions of order and receiving the goods.

It can be said that the second purpose of this model is to optimize the storage time. So, that, the storage time of goods to be close to its minimum. In mathematical expression:

$$\lim t(\mathrm{s}) \to 0LT = ALT$$

$t(S)\to$: is considered storage time

Describe the components of dynamic predictive model of the optimum time order for goods

Components of this model shown in Figures were as follows that each component may be a subsystem and with the activities of the system or equipment maintenance system, including storage devices, input and output to system:

Dynamic predictive subsystem

This sub-system is the most important part of the models. Existing program in this subsystem consists of a series of instructions that are based on methods and statistical calculations which the most notably is ARIMA algorithm. Since, the basis of this model is based on dynamic predictive algorithm or ARIMA. So, in this programming subsystem is done on a way that sub inputs received from other parts and related output results as following. Before that, briefly review predictive statistical algorithm ARIMA.

An overview of autoregressive integrated moving average algorithm

In statistics and econometrics, and especially in the time series, autoregressive integrated moving average algorithm is a general form of simple autoregressive moving average algorithm or ARMA. These models in time series are used to better understand of data or predict the next points. In some cases, this models in certain and clear points where data's shows one mode (non-stationary) causes to eliminates other parts of same series mode [5,9].

In general, the algorithm is shown as (p, d, q) ARIMA, in which b, d and q are integer that are greater or equal to zero and order related to regression, shows the combination of two regression mode and moving averages.

The terms and parameters of the algorithm

If time series data $X_{(t)}$ in which t is an integer index and $X_{(t)}$ be a series of real numbers, then $ARMA(p,q)$ model is shown as below [12,13].

$$(1-\sum_{i=1}^{\rho}\phi_i L^i)X_t = (1+\sum_{i=1}^{q}\phi_i L^i)\in_t$$

In which L is a lag operator and ϕ_i is the parameters of the ε_i auto regression part and θ_i is assumed to be the parameters of moving average part that is independent and are defined distribution of instance variables that generally considered to be normal distribution with mean zero.

$ARIMA(p,d,q)$ model is a generalization of the $ARMA(p,q)$ model (above) that is shown as follows.

$$(1-\sum_{i=1}^{\rho}\phi_i L^i)(1-\mathrm{L})^d \mathrm{X}_t = (1+\sum_{i=1}^{q}\phi_i L^i)\in_t$$

In which d is positive integer that shows the level of statistical difference (while d=0, existing model will be equivalent to $ARMA(p,q)$. Converting section to section difference to the size of d times in the process of model will be $ARMA(p,q)$. importantly, this is only adequate that shows auto regression difference section of $ARMA$. Because in elements always moving average are I (0). It should be noted that all selected features of the models do not always have good behavior especially if the model needs to stop (stationary). In which case the parameters should be adjusted [12,13].

Some known modes show themselves naturally. For example, $ARIMA(0,1,0)$ model is shown as below.

$$Xt = Xt - 1 + \in_t$$

That also said random walk to this mode. The application of this algorithm will be different in different modes and will be affected some of the variables in the different sectors. For example, if multiple time series were used in this model, Perhaps the use of vector autoregressive integrated moving average algorithm or VARIMA have proportion or if the time series data be seasonal such as road traffic control data and like that, in that case, the seasonal algorithm will have proportion with autoregressive integrated moving average algorithm or SARIMA [14,15]. Statistical analysis samples and operation of this algorithm on real time series data, that was conducted by using the R statistical software, has come in the following chapter.

Different Stages of Information Analysis

As stated in the article aims to simulate a dynamic model for critical items of ABC inventory control model in the form of material planning by using ARIMA statistical methods. At the beginning, autoregressive integrated moving average try to predict lead time by using time series methods and statistical methods and then, put up the predicted value in simulation model to be able to obtain delays in the form of orders distribution. Finally, to take advantage of dynamic model is used of V-masks control to identify unusual errors. At this stage, materials programming model deal with prediction of ordering and buying goods according to capacity constraints and changing the delivery time (for critical items for the ABC inventory model with dynamic potential). This model will relatively cure the difficulties of material planning with the assumption of constant delivery and also will reinforce previous models by covering how to increase the number of items. So, that, it reduced the costs resulted from ignoring above constraints in providing vital goods and losing incomes resulted from of delays and finally, lead to increasing the extraction of crude oil.

In the proposed model, dynamic predictive subsystem operates independently and also, needed time for ordering goods is compared with estimated and proposed time. Therefore, goods order time is considered different and system is always being managed in ordering manner that optimality of goods inventory is always guaranteed by this method. Economic order quantity (EOQ) model is used for a plan which is considered the economic value of the inventory in warehouse according to the requirements of the applicant (In drilling project management at national company of South's oil-rich, usually several drilling projects are planned together and simultaneously. According to this management approach, drilling project's good has more similarity to continuous goods than spend project's goods. So, kind of inventory control management also been mentioned in different sections. and sometimes in different sections have also been mentioned goods in way and previous inventory (items left from previous projects). Which will be discussed to predict lead time by using time series method. Among these time series methods, the method of ARIMA has been selected because it has less errors of squares totality. In fact, one of the purposes of this article is that how can have minimum of delay because the costs are a coefficient of delays and huge costs can be prevented by reducing them. Also, ordering goods can be programmed so that goods with more preparation time, be ordered earlier. In this way, delay time that is strongly increasing for certain goods became balanced.

Accordingly, in order to control changes in lead time, studied items is used from control mask (v-mask). These masks according to given definition of abnormal changes, remove abnormal data based on diagnostic criteria from carrousel and then, conducts the necessary calculations to predict new data. As well as, a range of positive or negative changes (e) defined in the first logging that this change actually is amounts of warehousing time or delay in receiving the goods. If the values be outside the desired scope, evaluation process is done as error. in such cases, or should changes acceptable ranges, or should be regardless of the error assessment process.

Also, sensitivity of matter in the method of estimating the optimal time for order, is depends on the stage of (p, d, q) parameters estimation. In this section, new predicted data compares with actual data, and reasons for possible differences between actual data and predicted data will be examined in risk management. In general, it can be said, the success of this method has a direct relationship with this step. Whatever risk management conducted better and the strengths and weaknesses of system identified better, can have a better expectation of desired system. At this stage, because there was no possibility of assess the strengths and weaknesses and reasons for the data distribution, was used trial and error method. In this method, different modes of shapes (p, d, q) were tested and Order (0,0,2) was considered as the best desired mode. There are a lot of patterns to check for errors. That intended error is the amount of delay time resulting from subtracting the predicted time with real time. In order to control errors, there are control mechanisms that after identifying imbalances, instantaneous command issued by using instantaneous feedback that this command causes the balance of system (For example, all of the factors affecting navigation system). In these mechanisms, all factors affects in guiding

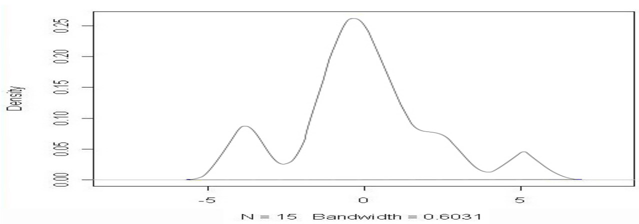

Figure 1: Time series errors.

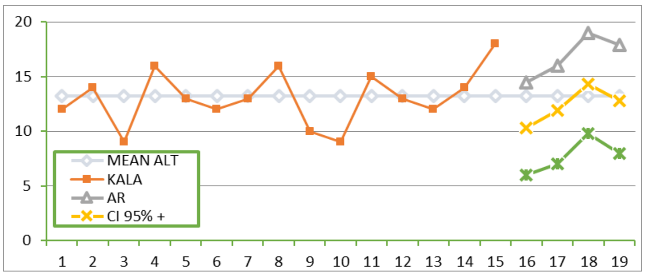

Figure 2: Fourteenth year prediction by using ARIMA algorithm (Between 1350-1365).

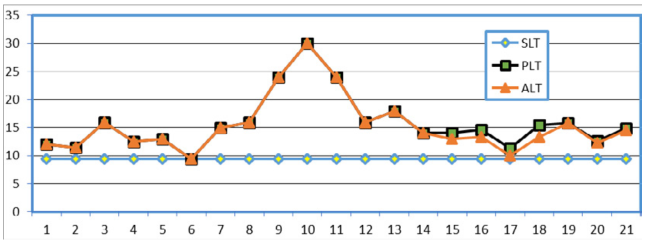

Figure 3: Amount of predicted difference data compared to the MRP model.

Row	Type of costs	Amount in RIS.	Period
1	Rig delay	500/000/000	Daily
2	Drilling mud and its filtration	120/000/000	Daily
3	Lateral Services	72/500/000	Daily
4	Transportation equipment	40/000/000	Daily
5	Exploitation unit because of decreasing of crude oil entrance (difference between real and nominal capacity)	120/000/000	Daily
Total daily 852/500/000			
Total monthly 25/575/000/000=30*852/500/000			
The lost opportunity costs (lost income)			
Row	**Type of costs**	**The formula for calculating the amount**	**Period**
1	Production delays for each well	barrels * current oil 3,000 prices (in dollars)	Daily
Total opportunity cost		**3000 * 60 * 3500 * 30**=189/000/000/000**RIS.**	
Total of costs		214/575/000/000	

Table 1: The cost elements associated related to drilling wells according to drilling program.

system (either quantitative or qualitative) to be considered and, appropriate outputs are provided under the title of control commands by analyzing them. Working principles governing these mechanisms is more based upon obtaining a three-dimensional matrix and a general rule of existing communications between changing errors. This general rule (RULE BASE) may be modification itself and from time to time modified existing laws with the processing of new information. This control systems are known as PID controller but in these systems, there are factors for validation of input data that identify inappropriate information and assess the temporary or permanent impact of them. After the study was conducted, ARIMA algorithm parameters has been calculated and time series errors has been obtained by using relevant coefficients which is shown in Figure 1.

In order to predict in ARIMA algorithm first of all, the number of requested data to predict is assumed 1, So that we can observed the predict trends. As seen in Figure 2, 14-years data (2000 to 2014) will be given as to the system as learning data in order to predict the year of 2015. Predict data is displayed in red in the Figure. As can be seen, calculated data by the system was 14.88843 and compare it with the actual amount represents the minor difference with its actual amount [16,18].

In Figure 3, a complete description of predict model has been shown. As can be seen, created models with regard to the learning data, have attempted to predict new data's that red line indicates predicted data and the blue line represents the actual data. As can be seen, model can be able to predict based on learning data that predicted differences data compared to the MRP model is much improved and time delay in receiving and warehousing goods in this case is reached to its lowest amount.

In continue, are paid to analysis the delay costs and the opportunity costs. Sample data analysis related to 12 critical received items from drilling management at national company of South's oil-rich are as follow: As can be seen in Tables 1-4, the difference between predicted data by using dynamic method is much less than proven method [19]. That this method can be save a lot on maintenance costs of goods in the warehouse and reduce delays in the delivery of project's goods, this in

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	Casing and Tubing																D/H and W/H Equipment							
	K1				K2				K3				K4				K5				K6			
	0407036051 18-5/8", 87.5, J55				04070352011 3-3/8", 68, J55				0414033751 9-5/8", 53.5, N-80				0412272351 7", 35#, L-80, VAM				0920001221 Casing HD. HSG21-1/4"				0920002041 Casing HEAD Spool21-1/4"			
PERIOD	ALT	ELT	DF (E)	DF (A)	ALT	ELT	DF (E)	DF (A)	ALT	ELT	DF (E)	DF (A)	ALT	ELT	DF (E)	DF (A)	ALT	ELT	DF (E)	DF (A)	ALT	ELT	DF (E)	DF (A)
1	14.01	FIT ORDER Base On (1.0.0)		5.01	14.17	FIT ORDER Base On (1.0.0)		5.17	13.2	FIT ORDER Base On (1.0.0)		4.2	13.11	FIT ORDER Base On (1.0.0)		4.11	13.09	FIT ORDER Base On (1.0.0)		4.09	14.17	FIT ORDER Base On (1.0.0)		5.17
2	16.29			7.29	13.17			4.17	14.15			5.15	16.11			7.11	14.15			5.15	13.17			4.17
3	11.04			2.04	20.24			11.24	19.2			10.2	11.1			2.1	19.2			10.2	18.24			9.24
4	16.08			7.08	15			6	14.24			5.24	15.1			6.1	13.24			4.24	3.15			-6.15
5	14.19			5.19	15.04			6.04	13.07			4.07	14.2			5.2	13.07			4.07	15.4			6.04
6	13.23			4.23	10.25			1.25	24.19			15.19	10.24			1.24	24.19			15.19	22.25			13.25
7	14.26			5.26	14.18			5.18	12.09			3.09	17.05			8.05	12.11			3.11	14.28			5.28
8	17.04			8.04	20.13			11.13	15.2			6.2	11.11			2.19	14.05			5.05	5.13			-4.13
9	8.24			-1.24	18.19			9.19	21.11			12.11	14.11			5.11	20.26			11.26	18.19			9.19
10	10.09			1.09	11.04			2.04	19.25			10.25	13.29			4.29	19.1			10.1	23.04			14.04
11	17.1			8.1	13.07			4.07	14.26			5.26	10.29			1.29	14.11			5.11	13.07			4.07
12	14.19			5.19	17.2			8.2	12.07			3.07	20.24			11.24	11.22			2.22	17.2			8.2
13	14			5	20.15			11.15	11.08			2.08	17.24			8.24	10.33			1.33	20.15			11.15
14	16.03			7.03	21.12			12.12	17.19			8.19	16.17			7.17	17.04			8.04	19.11			10.11
15	19.33			10.33	8.14			-1.14	17.13			8.13	18.15			9.15	16.28			7.28	19.14			10.14
16	12.24			3.24	19.14			10.14	10.11			1.11	14.21			5.21	9.26			0.26	19.15			10.15
17	17.19			8.19	20.15			11.15	18.04			9.04	15.26			6.26	17.19			8.19	21.27			12.27
18	19.24			10.24	12.14			3.14	5.19			-4.19	13.23			4.23	5.04			-4.04	9.14			0.14
19	20.28			11.28	13.14			4.14	19.14			10.14	15.29			6.29	18.29			9.29	18.13			9.13
20	18.23			9.23	12.15			3.15	22.21			13.21	10.2			1.2	16.08			7.08	23.13			14.13
21	17.16			8.16	14.16			5.16	3.11			-6.11	11.19			2.19	14.26			5.26	19.14			10.14
22	16.14			7.14	12.23			3.23	12.13			3.13	15.16			6.16	16.28			7.28	10.17			1.17
23	14.02			5.02	11.02			2.02	13.1			4.1	13.11			4.11	12.15			3.15	14.14			5.14
24	13.13			4.13	10.15			1.15	12.16			4.16	11.2			2.2	12.01			3.01	7.15			-1.15
25	16.25	14.69	1.56	7.25	14.01	14.45	-0.44	5.01	14.12	15.26	-1.14	5.12	13.1	14.25	-1.15	4.1	13.27	15.33	-2.06	4.27	18.23	15.7	2.53	9.23
26	13.27	15.36	-2.09	4.27	20.27	14.71	5.56	11.27	23.14	14.8	8.34	14.14	15.12	14.03	1.09	6.12	22.29	14.93	7.36	13.29	19.05	15.74	3.31	10.05
27	12.09	14.74	-2.65	3.09	8.2	15.34	-7.14	-1.2	9.26	13.19	-3.93	0.26	11.16	13.95	-2.79	2.16	9.11	13.03	-3.92	0.11	15.02	15.88	-0.86	6.02
28	16.14	14.37	1.77	7.14	16.14	14.97	1.17	7.14	12.02	16.3	-4.28	3.02	16.25	14.16	2.09	7.25	9.17	16.5	-7.33	0.17	13.14	15.92	-2.78	4.14
29	13.05	15.22	-2.17	4.05	13.25	14.71	-1.46	4.25	10.2	15.32	-5.12	1.2	12.11	13.73	-1.62	3.11	10.05	15.74	-5.69	1.05	18.08	15.86	2.22	9.08

Table 2: Statistical information about 12 crisis Goods in the national oil company.

turn, can prevent damages caused by stopping the project because of the shortage of goods [20].

According to Tables 2-6, The largest positive difference between predicted time with real-time of good's delivery has happened at K8. So, the biggest delay time in receiving is equal to 9.83 months. Meanwhile, negative values mentioned in the column means earlier receiving than prediction and is meant to warehousing time. With the information obtained can be said that, the amount of delay costs in conducting project is equal to the amount of delay value multiplied by the total cost of a month:

9.83*214,575,000,000 = 2,109,272,250,000

It is noteworthy, based on above calculations approximately amount of 2110 billion RIS. (70,309,075$) is minimum damages that has arisen in this project. Which shows the great importance of delay in receiving the goods [20-23].

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D/H and /H Equipment								Drilling Bits															
K7				K8				K9				K10				K11				K12			
0921002051 Tubing Head Spool 13-5/8"×11"				0919304701 TUB. HD. SPOOL11"×7-1/6"				0351900911 Rock BIT 26"				0351759011 Rock BIT 17-1/2"				0351659201 Rock BIT 12-1/4"				0351399501 Rock BIT 8-1/2"			
ALT	ELT	DF (E)	DF (A)	ALT	ELT	DF (E)	DF (A)	ALT	ELT	DF (E)	DF (A)	ALT	ELT	DF (E)	DF (A)	ALT	ELT	DF (E)	DF (A)	ALT	ELT	DF (E)	DF (A)
9.13	Fit Order Base On(1.0.0)		0.13	12.02	Fit Order Base On(1.0.0)		3.02	12.01	Fit Order Base On(1.0.0)		3.01	12.04	Fit Order Base On(1.0.0)		3.04	12.21	Fit Order Base On(1.0.0)		5.22	13.01	Fit Order Base On(1.0.0)		4.01
10.13			1.13	15.02			6.02	14.29			5.29	15			6	15.09			6.09	15.29			6.29
15.08			6.08	10.09			1.09	10.04			1.04	10.05			1.05	10.14			11.14	11.04			2.04
9			0	12.15			3.15	14.08			5.08	14.09			5.09	14.18			15.18	15.08			6.08
8.28			-1.28	12.19			3.19	12.19			3.19	12.22			3.22	13.09			4.09	14.19			5.19
12.05			1.05	12			3	11.23			2.23	11.34			3.34	12.03			3.03	10.23			1.23
9.12			0.12	13.03			4.03	12.26			3.26	12.27			3.27	13.06			4.06	17.04			8.04
28.17			19	9.29			0.29	16.04			7.04	16.05			7.05	16.14			7.14	11.09			2.09
11.11			2.11	8.16			-1.16	9.24			0.24	8.26			-1.26	10.14			1.14	14.1			5.1
0.26			9.26	15.07			6.07	8.09			-1.09	8.1			-1.1	8.19			9.09	13.19			4.19
10.23			1.23	16.11			7.11	15.1			6.1	15.11			6.11	15.2			6.2	10.24			1.24
10.1			1.1	24.01			15.01	12.19			3.19	12.22			3.22	13.09			4.09	20.23			11.23
12			3	29.28			20.28	12			3	12.03			3.03	12.2			3.2	17.23			8.23
10.18			1.18	23.28			14.28	14.03			5.03	14.04			5.04	14.13			5.13	16.16			7.16
16.16			7.16	15.21			6.21	17.19			8.19	17.2			8.2	17.29			8.29	18.14			9.14
11.11			2.11	17.11			8.11	10.14			1.14	11.17			2.17	11.04			2.04	14.2			5.2
10.15			1.15	13.25			4.25	15.19			6.19	15.22			6.22	16.09			7.09	15.25			6.25
10.14			1.14	12.18			3.18	17.24			8.24	17.25			8.25	18.04			9.04	13.13			4.13
9.1			0.1	15			6	19.23			10.23	19.24			10.24	20.03			11.03	15.25			6.25
11.15			2.15	12.02			3.02	16.23			7.23	16.25			7.25	17.13			8.13	10.27			1.27
8.14			-1.14	10.15			1.15	15.16			6.16	15.18			6.18	16.06			7.06	11.1			2.1
11.07			2.07	14.02			5.02	17.14			8.14	17.16			8.16	18.04			9.04	15.14			6.14
12.23			3.23	12.09			3.09	13.2			4.2	13.22			4.22	14.1			5.1	13			4
12.13			3.13	17.24			8.24	12.13			3.13	12.15			3.15	13.03			4.03	11.14			2.04
8.28	11.02	-2.74	-1.28	12	16.27	-4.27	3	14.25	14.35	-0.1	5.25	14.26	13.29	0.97	5.26	15.05	13.82	1.23	6.05	13	14.13	-1.13	4
15.02	11.19	3.83	6.02	14.1	12.84	1.26	5.1	11.27	14.19	-2.92	2.27	11.29	13.76	-2.47	2.29	12.14	14.4	-2.26	3.17	15.03	13.95	1.08	6.03
15.1	10.76	4.34	6.1	10.07	14.18	-4.11	1.07	10.1	14.3	-4.2	1.1	10.11	13.09	-2.98	1.11	10.2	13.57	-3.37	1.2	11.04	13.9	-2.86	2.04
12.16	11.03	1.13	3.16	15.11	14.18	0.93	6.11	14.14	14.05	0.09	5.14	14.15	12.63	1.52	5.15	14.24	12.82	1.42	5.24	16.24	14.04	2.2	7.24
10.05	11.23	-1.18	1.05	11.1	14.76	-3.66	2.1	11.05	13.93	-2.88	2.05	11.7	13.59	-1.89	2.07	11.25	14.03	-2.78	2.25	12.05	13.69	-1.64	3.05

Table 3: Statistical information about 12 crisis goods in the national oil company.

Conclusion

As shown in Tables 2 and 3, determined parametric plan alongside happened real data which is provided based on model, the new data is predicted and every time with delay factor control (which in the actual operating environment of risk management techniques can be used) can be able to limit the delays to zero. The amount of new predicted data has been shown in ELT column. And DF(A) column is difference value with fix amount in MRP that for these items 9 months is considered permanently. Obtained difference value has been shown in DF(E) column. Negative values means warehousing, and positive values means a delay in the receipt of goods. And of course, its zero value means timely arrival of goods that is an ideal state.

Since delay value of goods may be overlapped in analyzing damages, means that simultaneous delay of two or more goods to the same extent causes damages, so in this analysis, the largest time delay is intended as a determinant factor of minimal damage and based on

	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12
Average	14.95	14.73	14.53	13.93	14.34	15.88	11.27	14.22	13.33	13.39	13.88	13.87
Median	14.26	14.16	14.12	14.11	14.05	18.08	10.23	13.03	13.20	13.22	14.10	14.10
ST Deviation	2.81	3.85	4.98	2.5856	4.2871	5.1279	4.3646	4.5911	2.7181	2.734	2.7894	2.579
max	20.28	21.12	24.19	20.24	24.19	23.13	28.17	29.28	19.23	19.24	20.03	20.23
min	8.24	8.14	3.11	10.20	5.04	3.15	0.26	8.16	8.09	8.10	8.19	10.23
Variance	7.89	14.82	24.76	6.69	18.38	26.30	19.05	21.08	7.39	7.47	7.78	6.65

Table 4: Descriptive statistics about 12 crisis goods in the national oil company.

Result for lead time base on estimation (Month)			
SUM OF K1 LATENCY	3.33	SUM OF K1 STORING DATA	6.91
SUM OF K2 LATENCY	6.73	SUM OF K2 STORING DATA	9.04
SUM OF K3 LATENCY	8.34	SUM OF K3 STORING DATA	14.47
SUM OF K4 LATENCY	3.18	SUM OF K4 STORING DATA	1.62
SUM OF K5 LATENCY	7.36	SUM OF K5 STORING DATA	5.69
SUM OF K6 LATENCY	8.06	SUM OF K6 STORING DATA	3.64
SUM OF K7 LATENCY	9.30	SUM OF K7 STORING DATA	3.92
SUM OF K8 LATENCY	2.19	SUM OF K8 STORING DATA	12.04
SUM OF K9 LATENCY	0.09	SUM OF K9 STORING DATA	10.10
SUM OF K10 LATENCY	2.49	SUM OF K10 STORING DATA	7.34
SUM OF K11 LATENCY	2.65	SUM OF K11 STORING DATA	8.41
SUM OF K12 LATENCY	3.28	SUM OF K12 STORING DATA	5.63
Total	**57.00**	**Total**	**88.81**

Table 5: Compare the total latency and storage times.

Result for lead time base on static time (MRP)			
SUM OF K1 LATENCY	25.80	SUM OF K1 STORING DATA	0.00
SUM OF K2 LATENCY	27.67	SUM OF K2 STORING DATA	1.20
SUM OF K3 LATENCY	23.74	SUM OF K3 STORING DATA	0.00
SUM OF K4 LATENCY	22.74	SUM OF K4 STORING DATA	0.00
SUM OF K5 LATENCY	18.89	SUM OF K5 STORING DATA	0.00
SUM OF K6 LATENCY	38.52	SUM OF K6 STORING DATA	0.00
SUM OF K7 LATENCY	16.33	SUM OF K7 STORING DATA	1.28
SUM OF K8 LATENCY	17.38	SUM OF K8 STORING DATA	0.00
SUM OF K9 LATENCY	15.81	SUM OF K9 STORING DATA	0.00
SUM OF K10 LATENCY	15.88	SUM OF K10 STORING DATA	0.00
SUM OF K11 LATENCY	17.91	SUM OF K11 STORING DATA	0.00
SUM OF K12 LATENCY	22.36	SUM OF K12 STORING DATA	0.00
Total	**263.03**	**Total**	**2.48**

Table 6: Compare the total latency and storage times.

the largest delay time, possible damages be calculated. However, these damages when do not have overlapped in delayed receipt of goods, usually lumped together and considered higher amount of damages. In Table 4, final values in two state of static and dynamic were compared to each other and it has been shown that warehousing and goods delay became close to balance state. Nevertheless, analysis of prices delay has much influence in final determining of delay value. Of course, in goods in which delay value is so expensive, storage the mentioned goods are justified economically.

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