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ТЕРЕҢ ОҚЫТУ НЕГІЗІНДЕ НАҚТЫ УАҚЫТТА ОБЪЕКТІЛЕРДІ ТАҢУ

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РАСПОЗНАВАНИЕ ОБЪЕКТОВ В РЕАЛЬНОМ ВРЕМЕНИ НА ОСНОВЕ ГЛУБОКОГО ОБУЧЕНИЯ

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Аннотация. В статье разрабатывается ряд эффективных архитектур, которые решают вопросы увеличения исследований по эффективному моделированию мобильных устройств с ограниченными вычислительными мощностями и ресурсами памяти, что увеличивает потребность в использовании сверточной нейронной сети (CNN). Среди них архитектуры MobileNet, ShuffleNet и MobileNetV2, предложенные в последние годы. В исследовании делается вывод, что все эти модели основаны на глубокой изоляции, которая неэффективно реализована во многих системах глубокого обучения. Поэтому в данной работе мы предложили эффективную систему постоянной свертки. Затем мы предлагаем систему обнаружения объектов в реальном времени путем интеграции системы с детектором Single Shot MultiBox (SSD).

Ключевые слова: сверточная нейронная сеть, глубокое обучение, обнаружение объектов, эффективное моделирование, абляция.

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ANALYSIS OF THE MANAGEMENT OF MATERIAL AND TECHNICAL ASSETS OF ENTERPRISES

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Abstract. Variability of demand for goods, depending on their availability and cost is a frequently observed phenomenon in the sphere of production and consumption. This paper discusses the possibility of using the ABC analysis for the inventory management system. This

type of analysis makes it possible to apply various methods of inventory management for increasing the income and reducing the costs of particular products for manufacturers.

As is known, the management process approach emphasizes the systematic study of management by defining management functions in an organization and then examining each in detail. There is a general agreement on the planning, organizing, and controlling functions.

Traditional inventory management systems, such as the Lean Order Quantity (EOQ) model, are based on the assumptions of constant demand rate, constant inventory cost, and instant order. The EOQ assumption of instant order receipt means that the entire order quantity, that is, all units of the purchased lot is immediately received from the supplier. The Economic Production Quantity (EPQ) model weakens this assumption by including incremental order receipt, i.e. debit.

In recent years, major advances in the sphere of management include the following elements:

- process approach
- management science
- decision support approach,
- scientific approach to human resources development, and sustainable competitive advantage.

These four approaches complement one another in current practice and provide a useful framework for project management.

This paper presents a realistic model of the goods production and their inventory, since ABC analysis or ABC classification is an integral part of materials management. According to this approach, the inventory is divided into three categories depending on income generation. The ABC analysis helps entrepreneurs identify the main types of products in the warehouse, prioritize the goods management based on their cost, and analyze customer demand for a specific product.

Keywords: stocks, inventory management, ABC analysis, storage of goods, storage costs of goods, order, profit.

1. Structuring the material and technical assets of the enterprise

How do the companies using the operational research to improve their inventory policies determine when and in what volume to replenish their inventory?

Enterprise Asset Management (EAM) is a combination of software, systems and services used to maintain and control operational assets and equipment. The goal is to optimize the quality and use of assets throughout their entire lifecycle, increase uptime and reduce operating costs.

EAM includes work management, asset maintenance, planning and scheduling, supply chain management, and environmental health and safety (EHS) initiatives [1].

In the era of the Internet of Things, when all areas of our lives, from valves to vehicles connected by sensors and systems, are being embedded in advanced EAM analytics and artificial intelligence (AI), data

collected from instrumental assets is analyzed using AI techniques. The resulting insights help maintenance teams make better decisions, improve efficiency, perform proactive maintenance, and maximize investment in their physical assets.

EAM is often associated with Computerized Maintenance Management System (CMMS), but a closer look at EAM and CMMS reveals that CMMS may be one aspect of EAM, as CMMS focuses on centralizing information to facilitate and automate maintenance management processes, while EAM is an approach to asset lifecycle management that supports asset performance from acquisition to disposal [1, 2].

The importance of EAM is clear as it helps organizations track, measure, manage, and optimize asset quality and reliability. Organizations of all kinds have hundreds, thousands, and even millions of types and

categories of assets that are used in the course of a company's operation. Assets come in all shapes and sizes, from railroads, pipelines, manufacturing equipment, transportation fleets to windmills, and include virtually any equipment needed to support production, services, and operations.

Updates are made by service providers in the cloud, with the use of latest versions and functionality. Also, cloud technologies integrate new technologies faster and with less risk [2].

2. ABC analysis

Most business organizations view inventory management as one of the most challenging tasks though it is crucial to all areas of business such as manufacturing, retail, e-commerce, logistics and others. This helps entrepreneurs maintain optimal inventory levels and avoid stock-outs. ABC analysis is one of the best practices for helping managers optimize inventory levels. ABC analysis, also called ABC classification, is an integral part of materials management. It is an inventory classification method that splits the inventory into three distinct categories based on income generation. ABC inventory helps entrepreneurs and stockholders identify the main products in the warehouse and prioritize their management based on their value. Inventory analysis is based on the Pareto principle.

The Pareto principle is a popular economic theory discovered by the famous Italian economist Vilfredo Pareto, also known as the 80/20 rule [3]. Pareto believed that optimal economic growth occurs only at the expense of a small part of the economy. The Pareto Principle states that 80% of sales are accounted for by 20% of the most popular products. This means that the ratio between input and output is always unequal.

2.1 ABC Analysis Category

ABC analysis is based on the theory that all inventory items cannot have the same value.

Why is it important to use the ABC analysis for inventory management?

Many organizations have huge stock units or articles, but this is not conducive to their prosperity and business expansion. In

addition, there are various other problems of inventory management that an entrepreneur has to face such as inadequate knowledge of inventory, ineffective management process, the need to find solutions to problems in managing people and space, and others.

Inventory classification is a viable solution that can help businesses optimize their inventory management process. As the name suggests, inventory classification or categorization is a method of strategically pricing various products based on their value in demand. The ABC Inventory Method is a classification method that helps inventory managers solve all inventory management problems and maximize the inventory value of items.

Every product must go through four main stages: launch, growth, maturity, and decline. When a product reaches its optimal cost, demand for it inevitably drops at a certain point in time, known as the product life.

It is important to note that the lifespan of products depends on buyer's demand. This is where ABC inventory classification comes in handy as it helps businesses accurately analyze consumer needs. Business owners and inventory managers can analyze consumer needs for a specific product and manage their inventory to meet these needs. If the market for a product rises, the period of decline is postponed.

One of the significant concepts is that the unique selling points (USP) simplify and optimize the inventory management process using the ABC analysis. This helps the inventory managers organize and split their company inventory based on the goods annual consumption value and generated revenue. Products can also be categorized according to consumer needs [3, 4].

3. Practical application

ABC analysis is a widespread practice for grouping the stocks based on two factors of a unit cost and its quantity in stock, where the stocks are categorized into three main groups, allowing different stock management methods to be applied to different stock segments in order to increase income and reduce costs.

Each inventory category from A to B and C is a part of the total inventory and is a part of the total inventory value.

Category A items usually account for 15-20% of the total inventory by their types making up 80% of the inventory value. Items in this category are products with the highest annual consumption value.

Category B items account for 30% - 35% of inventory items by their types and about 15% of its value. Items in this category refer to goods with an average use value.

Category C items make up 50% of the stock but only 5% of the inventory value. Items in this category relate to goods with the lowest customer value [5].

The stages of ABC analysis are as follows:

1. Calculate the annual cost of all the items by way of multiplying the unit cost by the annual unit demand.
2. Sort the inventory in descending order of annual costs.
3. Calculate the total annual expenses and percentage of expenses
4. Divide your inventory into classes
5. Analyze the classes and make the appropriate decisions.

In this part of the paper, we will consider a dataset with the following information to show the use of the ABC analysis.

```
1 data_sub.head()
```

	SKU_number	PriceReg	ItemCount	File_Type	AddCost	RunCumCost	TotSum	RunPerc	Class	
	685	145889	244.6	851	Historical	208154.6	208154.6	3.426320e+08	0.000608	A
	601	435034	281.8	616	Historical	173588.8	381743.4	3.426320e+08	0.001114	A
	75056	538479	2645.3	49	Historical	129619.7	511363.1	3.426320e+08	0.001492	A
	5752	212633	235.6	521	Historical	122747.6	634110.7	3.426320e+08	0.001851	A
	3758	212480	208.8	579	Historical	120895.2	755005.9	3.426320e+08	0.002204	A

Figure 1- Overview of the dataset
Рисунок 1- Общий обзор набора данных

```
1 def ABC_segmentation(perc):
2     """
3     Creates the 3 classes A, B, and C based
4     on quantity percentages (A-60%, B-25%, C-15%)
5     """
6     if perc > 0 and perc < 0.6:
7         return 'A'
8     elif perc >= 0.6 and perc < 0.85:
9         return 'B'
10    elif perc >= 0.85:
11        return 'C'

1 # take a subset of the data, we need to use the price and the quantity of each item
2 data_sub = data[['SKU_number', 'PriceReg', 'ItemCount', 'File_Type']][data['File_Type'] == 'Historical']
3 # create the column of the additive cost per SKU
4 data_sub['AddCost'] = data_sub['PriceReg'] * data_sub['ItemCount']
5 # order by cumulative cost
6 data_sub = data_sub.sort_values(by=['AddCost'], ascending=False)
7 # create the column of the running CumCost of the cumulative cost per SKU
8 data_sub['RunCumCost'] = data_sub['AddCost'].cumsum()
9 # create the column of the total sum
10 data_sub['TotSum'] = data_sub['AddCost'].sum()
11 # create the column of the running percentage
12 data_sub['RunPerc'] = data_sub['RunCumCost']/data_sub['TotSum']
13 # create the column of the class
14 data_sub['Class'] = data_sub['RunPerc'].apply(ABC_segmentation)
```

Figure 2- Classification process by ABC analysis
Рисунок 2 - Процесс классификации по ABC анализу

```
2 performance = data_sub['AddCost'].tolist()
3 y_pos = np.arange(len(performance))
4
5 plt.plot(y_pos, performance)
6 plt.ylabel('Cost')
7 plt.title('ABC Analysis - Cost per SKU')
8 plt.grid(True)
9 plt.ylim((0,250000))
10 plt.show()
```

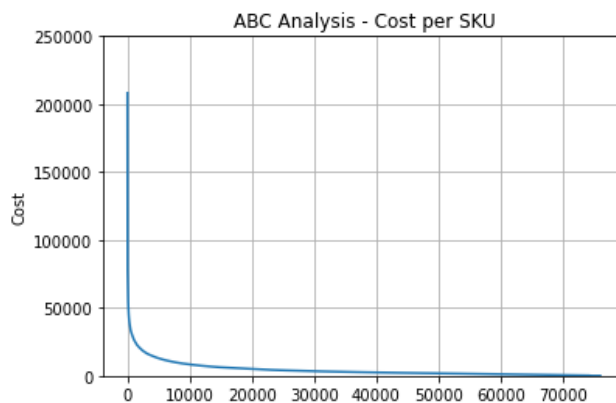


Figure 3 - Price of storage in the warehouse
Рисунок 3 - Цена хранения на складе

```
1 performance = data_sub['RunPerc'].tolist()
2 y_pos = np.arange(len(performance))
3
4 plt.plot(y_pos, performance)
5 plt.ylabel('Running Total Percentage')
6 plt.title('ABC Analysis - Cumulative Cost per SKU')
7 plt.grid(True)
8 plt.show()
```

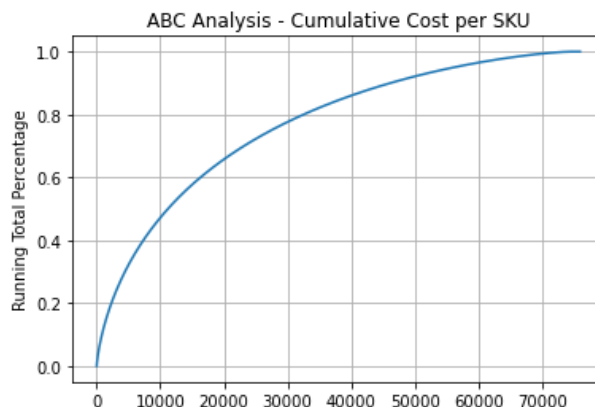


Figure 4 - Cumulative storage price per stock keeping unit (SKU)
Рисунок 4 - Кумулятивная цена хранения

Thus, category A items account for 21% of the total inventory by item and 60% of the inventory value while category B items make up 30% of the inventory items by item and about 25% of the cost. Finally, category C items account for 49% of actual items, but only for 15% of the inventory value [5, 6].

4. Conclusion

As can be seen from the results, use of our model can bring a good profit to the company. The dynamic and mathematical model and approach presented in our project has a very useful attribute that can be used by any distribution and manufacturing company with a similar inventory and demand system.

Therefore, the asset management is a key factor in the growth and success of a company.

In this paper, we examined the usage of ABC analysis. Company inventory managers should pay particular attention to A-class items and focus on that specific category. If a decrease in demand is detected for Category A products that no longer generate income, those products are downgraded.

With ABC classification, the company pursues such goals as, firstly, ensuring high competitiveness of supply costs, and secondly, increasing their cash flow because of the storage of products with high demand in the warehouse. In addition, the company can also collect information about its annual

expenses, orders and purchases, transportation costs, and others.

In carrying out this work it became obvious that when classifying the inventory based on demand according to the Pareto principle, the goods with the maximum price are at the top, whereas the product with the minimum price are at the bottom. In the last step, product managers must carefully analyze the categories and then distribute the goods based on revenue generation. This means that the item that made the most money will peak in its class, but it only contains a few sources of products. On the other hand, products that provide lower profitability will drop out from the list. In addition, inventory managers need to constantly monitor prices, customer demand, and product performance.

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АНАЛИЗ УПРАВЛЕНИЯ МАТЕРИАЛЬНО-ТЕХНИЧЕСКИМИ ЦЕННОСТЯМИ ПРЕДПРИЯТИЙ

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Аннотация. Изменчивость спроса на товар в зависимости от его наличия и стоимости - это часто наблюдаемое явление в сфере производства и потребления. В данной работе рассмотрена возможность применения ABC-анализа для системы управления производственно-товарными запасами, позволяющего применять различные методы управления запасами с целью увеличения дохода и снижения затрат производителей того или иного товара.

В данной статье представлена реалистичная модель производства товара и его инвентаризации, поскольку ABC-анализ или ABC-классификация -это неотъемлемая часть управления материальными потоками, при котором инвентарь подразделяют на три отдельные категории в зависимости от получения дохода. ABC-анализ помогает предпринимателям определять основные виды продукции на складе, расставлять приоритеты управления ими на основе стоимости, а также анализировать потребительский спрос в конкретном продукте.

Ключевые слова: запасы, управление запасами, ABC-анализ, хранение товаров, расходы по хранению товаров, заказ, прибыль.

КӘСПОРЫНДАРДЫҢ МАТЕРИАЛДЫҚ-ТЕХНИКАЛЫҚ ҚҰНДЫЛЫҚТАРЫН БАСҚАРУДЫ ТАЛДАУ

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Аңдатпа. Өнімге сұраныстың өзгеруі оның қол жетімділігі мен құнына байланысты өндіріс пен тұтыну саласында жиі байқалатын құбылыс болып табылады. Бұл жұмыста белгілі бір өнімді өндірушілердің кірісін арттыру және шығындарын азайту мақсатында қорларды басқарудың әртүрлі әдістерін қолдануға мүмкіндік беретін өндірістік және тауарлық қорларды басқару жүйесі үшін ABC талдауын қолдану мүмкіндігі қарастырылған.

Бұл мақалада өнімді өндірудің және оны түгендеудің нақты моделі келтірілген, өйткені ABC талдауы немесе ABC классификациясы материалдық ағындарды басқарудың ажырамас бөлігі болып табылады, онда түгендеу кіріс алуға байланысты үш бөлек санатқа бөлінеді. ABC талдауы кәсіпкерлерге қоймадағы өнімнің негізгі түрлерін анықтауға, оларды шығындар негізінде басқаруға басымдық беруге, сондай-ақ белгілі бір өнімдегі тұтынушылық сұранысты талдауға көмектеседі.

Түйінді сөздер: қорлар, қорларды басқару, ABC-талдау, тауарларды сақтау, тауарларды сақтау шығындары, тапсырыс, пайда.

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LIGHT REGULATION SYSTEMS IMPROVEMENT ANALYSIS TO FORECAST THE TRANSPORT FLOWS IN ALMATY

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Abstract. The number of vehicles on the roads of Almaty, Kazakhstan is growing from year to year. This brings about an increasing intensity and density of traffic flows in the streets which leads to congestion, decreasing speed of the traffic flow, increasing environmental pollution caused by car emissions, and which can potentially lead to the road traffic accidents (RTA), including fatalities.

While the number of injuries grows up mainly due to drivers' non-compliance with the speed limit, the environmental pollution is caused by longer traffic jams. Therefore, to reduce the