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A sustainable supply chain model based on blockchain considering uncertainty (case study: pharmaceutical industry)

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Abstract

In the modern supply chain, the coordination and cooperation of different members of the supply chain as well as the integration of production and commercial processes lead to achieving a competitive advantage and reducing costs. On the other hand, medicine is considered a strategic commodity, and the smallest disruption in its supply chain is possible. cause severe crises. For this reason, one of the most vital things in the drug industry is its supply chain. The weak response of suppliers to customers and lack of information sharing in the drug supply chain has caused weakness in the predictions of this industry. Among its notable features, it can improve some of the current challenges of the pharmaceutical industry's supply chain, including fraud, preservation, corruption, smuggling, theft, on-time delivery, and performance by improving the quality, speed, and reliability of delivery. In this research, an innovative model for blockchain-based supply chains in the supply chain of the pharmaceutical industry is presented and can provide an optimal path to this important industry.

Keywords:
Blockchain technology
Blockchain-based supply chain
pharmaceutical industry supply chain
Supply chain sustainability

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INTRODUCTION

Supply chain is considered an integrated process in which a group of organizations, such as suppliers, manufacturers, distributors, and retailers, work together to transform raw materials into final products and distribute them to final customers. One of the most important measures of society's progress is the state of its medical services, which is directly related to the timely and sufficient supply of vital drugs. Medicines are considered a strategic commodity, and the smallest disruption in their supply chain may cause severe crises. For this reason, one of the most vital aspects of the pharmaceutical industry is its supply chain. The pharmaceutical supply chain (PSC) consists of several stakeholders, including raw material suppliers, manufacturers, distributors, regulatory authorities, pharmacies, and hospitals (Ghahremani-Nahr, Aliahmadi, & Nozari, 2022).

Drug safety is always one of the biggest concerns because it directly affects the general health of society. Researchers and industrialists widely acknowledge that an essential strategy to ensure drug safety is to establish a reliable and traceable pharmaceutical system, which includes drug production, procurement, and sales (Korpela, Hallikas, & Dahlberg, 2017).

In today's digital world, policy alone cannot solve the challenges of legacy platforms that are not optimized to operate in the shared data economy. Recently, emerging technologies such as blockchain have been proposed in drug supply, which can be used in the field of security and optimization of the drug supply chain. Blockchain provides a distributed, secure, and transparent approach to information exchange in the supply chain. Blockchain can be used to understand the processes in the supply chain and its agents and to determine the exact time and location of each one. The information entered into the platform of blockchain technology is immutable, and other chain partners can track the shipment, delivery, and transportation (Aliahmadi, Nozari, & Ghahremani-Nahr, 2023). The features of decentralization, transparency, openness, immutability, data provenance, time-stamping, and auditability are useful to ensure that the problem of counterfeit and distributed drugs is contained. All transactions related to prescription drugs—from their production, distribution, and delivery to the final consumer—are registered, and all stakeholders are interconnected. In this way, any change or action in this area is detected by each of the parties, and with this approach, the production and distribution of counterfeit drugs becomes impossible. The traceability of low-quality drugs reaches the manufacturer, and even stolen drugs can be traced if registered at the time of production (Aliahmadi et al., 2022).

LITERATURE REVIEW

In recent years, much research has been conducted in the field of supply chains in the pharmaceutical industry. Surucu-Balci et al. (2024) investigated the blockchain network in drug manufacturing, which allows manufacturers to effectively control a drug in the supply chain while improving security and transparency in the entire process. This research also aims to minimize the cost and time of the manufacturing company to transfer the drug to the end user by providing mathematical models of direct and reverse supply chains. The direct supply chain model supports drug delivery from manufacturer to end user in less time with a reliable mode of delivery. The reverse supply chain model is explicitly focused on reducing the additional time and cost imposed on the manufacturer in pursuing defective drug readouts. In addition, a real implementation of a blockchain-enabled supply chain management system is performed to demonstrate process transparency.

Dehshiri and Amiri (2024) presented a conceptual model of sustainable supply chain management (SSCM) in small and medium enterprises (SMEs) using blockchain technology (BT). With the increasing focus on sustainable business processes, research on SSCM is highlighted. BT is a game-changing technology that can impact SSCM. Using the available literature, the antecedents of SSCM using BT have been characterized. Multi-criteria decision-making has been used to develop the conceptual model.

Quayson et al. (2024) investigated how blockchain technology affects supply chain practices and policies. In this research, a systematic review of academic and work literature was conducted. Additionally, to gain further insight, several surveys on blockchain adoption in the industry were utilized. While blockchain technologies are in the early stages of their introduction, they hold a special place in supply chains. Trust is an important factor that leads to their acceptance. The value of such technologies for supply chain management lies in four areas: extended visibility and traceability, supply chain digitization, improved data security, and smart contracts. This research also identifies many challenges, gaps in understanding, and opportunities for future research.

Hu et al. (2024), using resource-based perspectives, outlined the concepts of supply chain and blockchain. This study identifies the types of resources required for the successful implementation of blockchain and ultimately the potential achievement of a beneficial supply chain perspective.

Nozari (2024) investigated how ERP systems along with blockchain technology will be powerful tools to improve supply chain operations. His research shows how these two technologies will complement each other in every aspect of supply chain functions, bringing transparency, efficiency, and cost reduction.

This research collectively demonstrates that efforts to use blockchain technology in the field of supply chain management are increasing exponentially.

MATHEMATICAL MODELLING

The current research seeks to provide a sustainable supply chain model based on blockchain as if it includes manufacturers, distributors, and pharmacies. Distributors and pharmacies can connect to the blockchain system. If they connect to these systems, they automatically record their drug needs, for example, pharmacies record how many drugs they have sold and therefore how much and what kind of medicine they need for the course. This is also true for distributors. Distributors also make informed decisions for future orders through the blockchain system registration of drugs and their quantities. However, pharmacies or distributors that do not connect to this system face uncertain or scenario demand. That is, it is not clear how much their demand is in each period. Therefore, connecting to the blockchain system leads to the certainty of the demand because the demand is recorded by the blockchain, while not connecting to it leads to the uncertainty of the demand. Finally, a three-objective model based on reducing costs, reducing environmental issues, and increasing employment or social responsibility is designed.

The assumptions of the model are as follows

- It is possible to choose and not choose the blockchain system.
- The supply chain is three-level, multi-product and multi-period.
- Employment rate is determined based on inventory and production rate
- The amount of energy consumption is determined based on the inventory and the amount of production.
- The cost of storage varies per pharmacy and distributor.
- The cost of production is considered different for each manufacturer.
- Manufacturers, distributors and pharmacies have limited capacity.
- **Indices**

I	Producer
J	Distributor
K	pharmacy
P	product
T	period
s	scenario

- **Parameters**

FJ_j	The cost of constructing a distributor j
FK_k	The cost of constructing a pharmacy k
DIJ_{ij}	Distance between producer i and distributor j
DJK_{jk}	Distance between distributor j and pharmacy k
TC	Unit transfer fee
BDK_{kt}	The amount of demand for product p in pharmacy k in period t recorded by the blockchain system

BDJ_{jt}	The amount of demand for product p at distribution center j in period t recorded by the blockchain system
DK_{kts}	The amount of demand for product p in pharmacy k in period t without blockchain system under scenario s
DJ_{jts}	Demand rate of product p at distribution center j in period t recorded without blockchain system under scenario s
$CAPI_i$	Producer capacity i
$CAPJ_j$	distributor capacity j
$CAPK_k$	Pharmacy capacity k
BCK	The cost of connecting to the blockchain system for the pharmacy
BCJ	The cost of connecting to the blockchain system for the distributor
MC_i	Unit cost of drug production by the manufacturer i
DC_j	The unit cost of drug storage by the distributor j
KC_k	Drug storage unit cost by pharmacy k
ECI_{ip}	The amount of energy consumed per unit of product p by producer i
ECJ_{jp}	The amount of energy consumption per unit of product p by distributor j
ECK_{kp}	The amount of energy consumption per unit of product p by pharmacy k
$EMPI$	The number of labor required for the producers of each unit of product
$EMPJ$	Number of labor required for distributors per unit of product
$EMPK$	The number of labor required for the pharmacy per unit of inventory
MM	A big number

- **Decision variables**

XJ_j	1 if distributor j is built and zero otherwise
XK_k	1 if pharmacy k is built and zero otherwise
XIJ_{ij}	Transfer flow of product p between manufacturer i and distributor j
XJK_{jk}	Transfer flow of product p between distributor j and pharmacy k
YBK_{kt}	Inventory of product p in pharmacy k in period t based on blockchain system
YBJ_{jt}	Inventory of product p in distribution center j in period t based on blockchain system
YK_{kts}	Inventory of product p in pharmacy k in period t without blockchain system under scenario s
YJ_{jtsp}	Inventory of product p at distribution center j in period t without blockchain system under scenario s
ZK_k	1 if pharmacy k connects to the blockchain system and zero otherwise
ZJ_j	1 if distributor j connects to the blockchain system and zero otherwise
U_i	The amount of drug production by the manufacturer i
$JOBI_i$	The amount of production of employment by the producer i
$JOBJ_j$	The amount of employment produced by the distributor j
$JOBK$	The amount of employment generated by the pharmacy k
VI_{ipt}	The energy consumption of producer i in period t for product p
VJ_{jpt}	The energy consumption of distributor j in period t for product p
VK_{kpt}	Energy consumption of pharmacy k in period t for product p

Objective functions

$$\begin{aligned}\text{Min } z1 = {} & \sum_j FJ_j\, XJ_j + \sum_k FK_k\, XK_k \\ & + \sum_i \sum_j DIJ_{ij}\, TC\ \ XIJ_{ij} \\ & + \sum_j \sum_k DJK_{jk}\, TC\ XJK_{jk} \\ & + \sum_j BCJ\ \ Z_j + \sum_j BCK\ \ Z_k \\ & + \sum_i MC_i\ \ U_i \end{aligned} \tag{1}$$

$+\sum_j\sum_t\sum_p DC_j\ YBJ_{jtp} + \sum_k\sum_t\sum_p KC_k\ YBK_{ktp} + \sum_j\sum_t\sum_p\sum_s DC_j\ YJ_{jtsp} + \sum_k\sum_t\sum_p\sum_s KC_k\ YK_{ktsp}$	
$\text{Min } z2 = \sum_i\sum_p\sum_t VI_{ipt} + \sum_j\sum_p\sum_t VJ_{jpt} + \sum_k\sum_p\sum_t VK_{kpt}$	(2)
$\text{Max } z2 = \sum_i\sum_p JOBI_{ip} + \sum_j\sum_p JOBJ_{jp} + \sum_k\sum_p JOBK_{kp}$	(3)

S.t

$\sum_j XJ_j \geq 1$	(4)
$\sum_k XK_k \geq 1$	(5)
$\sum_i XIJ_{ij} \leq CAPJ_j$	(6)
$XIJ_{ij} \leq MMXJ_j$	(7)
$\sum_j XJK_{jk} \leq \sum_i XIJ_{ij}$	(8)
$\sum_j XJK_{jk} \leq CAPK_k$	(9)
$XJK_{jk} \leq MMXK_k$	(10)
$U_i \leq \sum_j XIJ_{ij}$	(11)
$U_i \leq CAPI_i$	(12)
$YBJ_{jtp} \leq MMZ_j$	(13)
$YBJ_{jtp} = YBJ_{jt-1\,p} + \sum_i XIJ_{ij} - BDJ_{jt}$	(14)
$YBK_{ktp} \leq MMZ_k$	(15)
$YBK_{ktp} = YBK_{kt-1\,p} + \sum_j XJK_{jk} - BDK_{kt}$	(16)
$YJ_{jtsp} = YJ_{jt-1\,p} + \sum_i XIJ_{ij} - DJ_{sjt}$	(17)
$YK_{ktsp} = YK_{kt-1\,sp} + \sum_j XJK_{jk} - DK_{kts}$	(18)
$VI_{ipt} = ECI_{ip}U_i$	(19)
$VJ_{ipt} = ECJ_{jp}YBJ_{jtp} + ECJ_{jp}YJ_{jtsp}$	(20)
$VK_{kpt} = ECK_{kp}YBK_{ktp} + ECK_{kp}YK_{ktsp}$	(21)
$JOBI_{ip} = EMPI/U_i$	(22)
$JOBJ_{jp} = \frac{EMPJ}{YBJ_{jtp} + YJ_{jtsp}}$	(23)
$JOBK_{kp} = \frac{EMPK}{YBK_{ktp} + YK_{ktsp}}$	(24)
$XJ_j \in \{0.1\}$	(25)
$XK_k \in \{0.1\}$	(26)
$ZK_k \in \{0.1\}$	(27)
$ZJ_j \in \{0.1\}$	(28)
$XIJ_{ij} \geq 0$	(29)
$XJK_{jk} \geq 0$	(30)
$YBK_{ktp} \geq 0$	(31)
$YBJ_{jtp} \geq 0$	(32)
$U_i \geq 0$	(33)
$JOBI_{ip} \geq 0$	(34)
$JOBJ_{jp} \geq 0$	(35)
$JOBK_{kp} \geq 0$	(36)
$VI_{ipt} \geq 0$	(37)
$VJ_{jpt} \geq 0$	(38)
$VK_{kpt} \geq 0$	(39)

Eq. (1) seeks to minimize the costs of the drug supply chain. Eq. (2) seeks to minimize the environmental issues of the drug supply chain. Eq. (3) seeks to maximize social responsibility in the drug supply chain. Eq. (4) shows that at least one distributor should be built. Relation (5) shows that at least one pharmacy should be built. Relation (6) shows that the total transfer flow to the distributors cannot exceed their capacity. Eq. (7) states that if the distributor is not built, there will be no flow for it. Eq. (8) shows that the total flow sent from distributors to pharmacies cannot naturally exceed the total flow sent from manufacturers to distributors should be more. Eq. (9) shows that the total flow sent from all distributors to pharmacies cannot exceed the capacity of pharmacies. Relationship (10) states that if a pharmacy is built, there will be a flow for it. Eq. (11) shows that the amount of production by a producer cannot be more than the flow sent to all distributors. Eq. (12) shows the limitation of the producer's capacity. chain is selected for a distributor; the inventory is recorded based on it. Eq. (14) seeks to calculate the amount of inventory based on the blockchain. Eq. (15) states that if the blockchain system is selected for the pharmacy, the inventory is based on the blockchain chain is calculated. Equation (16) calculates the amount of inventory for the pharmacy based on blockchain. Eq. (17) calculates the amount of inventory without blockchain for distributors. Eq. (18) calculates the amount of inventory without blockchain for Pharmacies. Equation (19) calculates the amount of energy consumption for the manufacturer. Eq. (20) deals with the calculation of the amount of energy consumption for the distributor. Eq. (21) deals with the calculation of the amount of energy consumption for the pharmacy. Equation (22) deals with the calculation of the amount of employment produced by the manufacturer. Eq. (23) deals with the calculation of the amount of employment produced by the distributor. Eq. (24) deals with the calculation of the amount of employment produced by the pharmacy. Equation (25) to (28) determine the range of binary variables. Relations (29) to (41) include the range of integer variables.

SOLUTION METHOD

The $NSGA\ II$ algorithm is one of the fastest optimization algorithms, which has less operational complexity than other methods and obtains Pareto optimal points by using the principle of non-overcoming and calculating the crowding distance. In NSGA II, the preservation of elitism and fragmentation is considered simultaneously. The selection of the new population in each step of this method is based on the principle of predominance, and by using elitism and ranking of the population in each step of the solution, it selects the best non-defeated answers and goes to the next step.

Also, to observe the appropriate distribution of the density of answers in this algorithm, a concept called crowding distance is used. In general, to sort a population of size n based on the levels of outliers, each answer is compared to all other answers in the population to determine whether that answer is an outlier or not. In the end, there are several solutions, none of which are dominant or defeated by each other, so these solutions form the first boundary of non-defeated boundaries. These answers are transferred to the set F_1. To determine the answers in the next boundaries, the answers in the first boundary are temporarily ignored and the above process is repeated, and this time the answers are transferred to the F_2 set and get the second rank. This process continues for all non-defeated answers of the population. One of the desired criteria of the evolutionary algorithm on the way to reach the optimal Pareto boundary is to maintain the variety and extent of the answers in the set of obtained answers. Sorting the non-defeated ones is a procedure to reach better answers, and the diversity mechanism also tries to maintain diversity and breadth in these answers. In this algorithm, this is done by the crowding distance in this way. A smaller value of the crowding distance of an answer indicates a greater density of answers around it.

For the next step, the solutions that are in an area with less density or in other words with a greater crowding distance should be selected. By doing this, the diversity and dispersion in the obtained answers increases. The purpose of using the crowding distance in NSGA II is to create diversity in the answers of the population and it indicates the density of the answers next to a specific answer. The crowding distance for answers sorted in ascending order and specific to set F is obtained from Eq. (40).

$$CD(X^1) = CD(X^S) = \infty \quad (40)$$

$$CD(X^i) = \left[\frac{Z_1(X^{i+1}) - Z_1(X^{i-1})}{Z_1(X^S) - Z_1(X^1)}\right] + \left[\frac{Z_2(X^{i+1}) - Z_2(X^{i-1})}{Z_2(X^S) - Z_2(X^1)}\right], i = 2, \dots, S-1$$

In the above relation, $CD(X^i)$ is the crowding distance for the solution X^i. After merging the parent and offspring populations, non-regressive sorting is performed and steps 7 and 8 described below are performed. Based on step 10, the crowding distance criterion is used to create a subset of the last non-defeated set and due to the increase in the size of the next population:

Step 1: Create an initial population $P_0$of size N with random answers and set $t = 0$,

Step 2: If the stop condition is not established, return to P_t.

Step 3: Select N parents from the population P_t using the binary competitive selection operator,

Step 4: By applying the crossover and mutation operators on the population P_t, create a population of children Q_t of size N,

Step 5: Put $R_t = P_t \cup Q_t$,

Step 6: Use the non-inferior ranking method to determine the Pareto sets F_i in the population R_t.

Step 7: Put $P_{t+1} = \emptyset$ و $i = 1$،

Step 8: until $|P_{t+1}| + |F_i| < N$

a. Add the answers of the set $F_i$to the population P_{t+1}, and b. Put $i = i + 1$.

Step 9: Sort the answers of the set F_i according to the crowding distance and in descending order.

Step 10: As much as $N - |P_{t+1}|$ Transfer from the first solutions F_i to the population P_{t+1}, and

Step 11: Set $t = t + 1$ and return to step 2.

RESEARCH FINDINGS

In order to analyze the model in this research, 20 modes have been considered. By increasing the dimensions of the model problem, it can be solved to some extent, and

from the tenth example onwards, the problem cannot be solved using the exact method, so meta-heuristic algorithms should be used to solve the problem. The selected algorithm at this stage is the NSGA II algorithm, in this section we are looking to compare its results with the exact method. This comparison is made in Table 1.

Table 1: Comparison of exact method and NSGA II algorithm

Problem	The exact method				NSGA II algorithm				Gap			
	Cost	environmental issues	Social responsibility	Calculation time	Cost	environmental issues	Social responsibility	Calculation time	Cost	environmental issues	Social responsibility	Calculation time
1	570845	42322	17096	5	570841	42320	17089	5	4	2	7	0
2	572065	43736	17260	15	572058	43732	17245	15	7	4	15	0
3	573405	44939	17429	20	573374	44930	17412	18	31	9	17	2
4	574844	46174	17603	28	574810	46154	17585	24	34	20	18	4
5	576709	48045	17721	33	576670	48020	17703	29	39	25	18	4
6	577916	49171	17896	41	577875	49138	17875	37	41	33	21	4
7	579826	50580	18072	46	579780	50546	18051	42	46	34	21	4
8	581712	51674	18208	51	581656	51635	18173	47	56	39	35	4
9	583109	53393	18335	61	583037	53348	18292	56	72	45	43	5
10	584214	54513	18474	71	584131	54468	18424	66	83	45	50	5
11	…….	…….	…….	low memory	599006	55832	19716	72				
12	…….	…….	…….	low memory	618747	56979	21410	77				
13	…….	…….	…….	low memory	637535	58661	23371	82				
14	…….	…….	…….	low memory	654954	60030	24816	92				
15	…….	…….	…….	low memory	673999	61372	25817	102				
16	…….	…….	…….	low memory	687268	63138	27162	108				

Problem	The exact method				NSGA II algorithm				Gap			
	Cost	environmental issues	Social responsibility	Calculation time	Cost	environmental issues	Social responsibility	Calculation time	Cost	environmental issues	Social responsibility	Calculation time
17	…….	…….	…….	low memory	706465	64324	28807	116				
18	…….	…….	…….	low memory	722972	65832	30002	126				
19	…….	…….	…….	low memory	737574	66908	31373	132				
20	…….	…….	…….	low memory	748592	68643	32646	142				

As it can be seen, with the increase in the dimensions of the problem, the gap between the two methods increases and the biggest gap is observed in the cost. which indicates the superiority of this method over the exact method. On the other hand, with the increase in dimensions, the distance between the results of the two methods increases, and the calculation time also has a huge gap, which of course is the biggest gap in cost, then in environmental issues, and finally in social issues.

In the following, the sensitivity analysis is discussed. In the sensitivity analysis, the reaction of the model to changes in some parameters is checked, considering that the focus of the present research is on the use of the blockchain system, in this section, the effect of connecting to the blockchain system and costs are examined. imposed is addressed. In the table below, it is checked that the connection to the blockchain system will cause changes in the objective functions of the current research, which is based on sustainability. The results are presented in Table 2.

Table 2: Sensitivity analysis of connecting and not connecting to the blockchain system in the drug supply chain

Problem	Connecting to the blockchain system			No connection to the blockchain system			Contradiction			Percent discrepancy		
	Cost	environmental issues	Social responsibility	Cost	environmental issues	Social responsibility	Cost	environmental issues	Social responsibility	Cost	environmental issues	Social responsibility
1	570841	42320	17089	583171	43255	16230	12330	935	859	0.021143	0.021616	0.052927
2	572058	43732	17245	589325	44661	16490	17267	929	755	0.0293	0.020801	0.045785
3	573374	44930	17412	583573	45613	16613	10199	683	799	0.017477	0.014974	0.048095
4	574810	46154	17585	585873	46901	16750	11063	747	835	0.018883	0.015927	0.049851
5	576670	48020	17703	588174	48550	16821	11504	530	882	0.019559	0.010917	0.052434
6	577875	49138	17875	593522	49669	17064	15647	531	811	0.026363	0.010691	0.047527
7	579780	50546	18051	591843	51370	17180	12063	824	871	0.020382	0.01604	0.050698
8	581656	51635	18173	594885	52508	17617	13229	873	556	0.022238	0.016626	0.03156

Problem	Connecting to the blockchain system			No connection to the blockchain system			Contradiction			Percent discrepancy		
	Cost	environmental issues	Social responsibility	Cost	environmental issues	Social responsibility	Cost	environmental issues	Social responsibility	Cost	environmental issues	Social responsibility
9	583037	53348	18292	602175	54111	17308	19138	763	984	0.031781	0.014101	0.056852
10	584131	54468	18424	595455	55396	17862	11324	928	562	0.019017	0.016752	0.031463
11	599006	55832	19716	616141	56614	19126	17135	782	590	0.02781	0.013813	0.030848
12	618747	56979	21410	638603	57925	20559	19856	946	851	0.031093	0.016331	0.041393
13	637535	58661	23371	649376	59584	22754	11841	923	617	0.018234	0.015491	0.027116
14	654954	60030	24816	673627	60915	24310	18673	885	506	0.02772	0.014528	0.020814
15	673999	61372	25817	690086	62335	24825	16087	963	992	0.023312	0.015449	0.03996
16	687268	63138	27162	702293	63760	26236	15025	622	926	0.021394	0.009755	0.035295
17	706465	64324	28807	724996	64951	28124	18531	627	683	0.02556	0.009653	0.024285
18	722972	65832	30002	733061	66402	29433	10089	570	569	0.013763	0.008584	0.019332
19	737574	66908	31373	749434	67548	30757	11860	640	616	0.015825	0.009475	0.020028
20	748592	68643	32646	766986	69304	31898	18394	661	748	0.023982	0.009538	0.02345

CONCLUSION

The point of the current investigate was to supply a maintainable supply chain show beneath vulnerability and based on blockchain. Based on this, library thinks about were conducted, the comes about of which indicate a investigate crevice within the field of utilizing blockchain within the maintainable sedate supply chain. Based on the studies, a three-objective feasible supply chain show was outlined based on maintainability. The primary objective is cost diminishment, the moment objective is to diminish natural issues, and the third objective is to extend business or social issues. The displayed demonstrate was to begin with illuminated in little. measurements to check its legitimacy, at that point it was analyzed in expansive measurements utilizing NSGAII calculation. The comes about appeared that the utilize of blockchain framework can lead to taken a toll enhancement and natural issues. and increment work and in common at all levels it can lead to enhancement of answers, whereas not utilizing it can increment costs and of course instability since not utilizing blockchain will diminish the request in conveyance centers and drug stores. The result is dubious and the increment of this instability leads to the disintegration of the answers.

In this study, the medicate supply chain model was separated into three parts, creating conveyance centers and drug stores, which shaped the layers of the supply chain. In this chain, the hubs had the specialist to connect the blockchain framework, that is, any drug store or conveyance center seems to connect the framework. Blockchain is associated, which brings benefits and costs to the supply chain. At long last, three maintainability objectives, i.e. diminishing costs, lessening natural issues, and increasing social duty within the business frame, were taken within the current inquiry about the show. The joining of drug stores and dispersion centers to the blockchain framework despite the burden of an expense can cause the demand to be decided and the request to be enrolled within the blockchain framework, whereas not interfacing them to the blockchain framework can cause the instability of the request.

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