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IMPLEMENTATION OF THE DECISION MAKING ALONG WITH ANALYTIC HIERARCHY PROCESS (AHP) APPROACHES IN THE ASSESSMENT OF THE PETROLEUM PRODUCTS COST BASED ON THE STATICAL MODEL

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In this study, the investigation of the decision-making strategy was used to select the alternative that was finally adopted in the crude oil refining process. This strategy was used to select the option that was ultimately implemented in the process. The Doura industrial refinery was the source of the information that was acquired for the analysis. The super decision software was applied in order to carry out an examination of the PDS components. After going through the process of refining, one can get the items on the following list: There are five main types of petroleum products, and they are: gasoline, gas oil, liquid gas, black oil, and white oil. Gasoline is the most common type of petroleum product. In order for the parameters to be optimally accommodated by the solution that is finally decided to be the most practical one, the analytic hierarchy process, also known as AHP, technique has been applied. This has been done in conjunction with the parameter determination system, or PDS. This has been done in order to reach the maximum potential level of productivity in the most efficient manner. As a result of the fact that this was the circumstance, a probe into the preliminary phase of the project was carried out, which in the end resulted in the expenditure of a grand total of 3,969,463 USD. This was determined by taking into account the costs of running the firm in addition to the prices of the raw materials that were utilized in the production process. In addition, the output of the refining process was not only dependent on the price and quantity of the product, but also on the amount of product that was actually sold. This meant that the cost and quantity of the product were not the only factors that determined the output. In order to determine what should be done during the process of making an estimate of what should be done in order to arrive at the response that was going to be the most advantageous taking everything into consideration, a mathematical model was applied as part of the process

Keywords: AHP, decision-making-statistical model, petroleum, cost, PDS, crude oil

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1. Introduction

Joint products are products made from the same raw material, but the productive art, degree of technological progress, and nature of the final product in the manufacturing industries differ from the extraction industries, so the productive art used in oil extraction differs from the productive art used in iron or coal extraction. But they're both extractive [1] industries. To accurately estimate the direct costs of joint goods, it is impossible to accurately estimate the costs of raw materials, labor and other facilities. An organization's administrative and financial decision-making relies heavily on procedures for distributing shared expenses and for calculating and assigning shared expenses. In any case, these choices have an impact on the company's bottom line [2]. Since these costs must be distributed fairly among all the joint products acquired, correct accounting procedures are followed in order to ensure adequate stock assessment, calculate a reasonable selling price for each product and ensure the profitability of every production line [3].

An unstructured decision-making problem that calls for the participation of experts or decision-makers can be solved using group decision-making (GDM). Prior to making a conclusion, a group of people need to have a wide-ranging and in-depth discussion of the topics. Consensus and selection are the two most common GDM techniques [4]. In a consensus process, a moderator, who does not participate in the debate but is aware of the agreement at any given time, serves as an intermediary. A moderator oversees and guides a consensus process to reach the maximum possible agreement and lower the number of experts who are not in accord [5]. Experts' perspectives are gathered and combined to produce a collection of solutions for the problem at hand [6]. This is how the selection process comes to fruition.

Two alternative pairings, two alternative alternatives, and relations between them were all used to calculate the degree of agreement in [7]. They were used to assist experts in revising their positions and to gauge the degree to which the views of individual experts align with those of the group. It was proposed that [8] use MCDM to rate a variety of different algorithms or methodologies by looking at algorithm selection as an MCDM problem [9]. Experts and a moderator engage in a dynamic exchange of ideas during the consensus process. When a person's opinion shifts, the particular expert aims to enhance his or her interest or re-turn [10]. Consensus in GDM can be facilitated by constructing two kinds of soft cost consensus models from a moderator's and an expert's perspective, respectively, to account for the costs and payments involved in the process. It is also examined how the two models interact with each other. Real-world GDM difficulties often call for compromises based on a common understanding of minimal costs rather than more time-consuming and expensive unanimous decisions. As a result, in GDM, both the level of agreement and the cost of agreement are key considerations [11]. Consensus degrees, on the other hand, did not provide a cost estimate, while the literature on minimum cost consensus did not take into account the degree of consensus [12].

Therefore, study that is devoted to investigating how the AHP and Decision-making Method can be applied in practice by predicting the oil prices scientific relevance**.**

2. Literature review and problem statement

Many management problems necessitate the simultaneous examination of many elements and the reliance on the subjective opinions of experts, making the approach to picking important factors critical in matters of cost management specification for some time. Because it is so helpful in picking the alternative that will cost the least amount of money, the Analytic Hierarchy Process (AHP) method has seen a lot of action in multi-attribute decision-making settings in recent years. With its ease of use, flexibility to incorporate many elements with quantitative and qualitative features as well as extensive applications and publications, the AHP is widely used [13]. Decision support systems using the AHP technique have been effectively deployed in various areas of construction management, including the assessment of cutting-edge construction technology [14]. The AHP methodology is used to identify which alternative provides the management section's good area with the most advantageous scenario possible.

Selection and evaluation of equipment and asset management models are evaluated in this process.

With the assistance of AHP and decision-making considerations for cell formation and machine selection, a heuristic algorithm may be utilized to build an altogether new production system. This can be accomplished with the help of AHP. The cost of production would be the system's major emphasis throughout the entire process. For study [15] the performance of AHP was discussed as it relates to decision-making on the magneto-adsorbent that is most suited for the removal of methylene blue. In particular, a comparison was carried out on four distinct kinds of adsorbents, one of which was comprised of bare Fe_3O_4 nanoparticles. They described the steps for the AHP using this method, which comprises the following:

– step 1. Define the problem and determine the goal;

– step 2. Develop the hierarchy structure from the highest level (objective) through the intermediate level (criteria) to the lowest level (alternatives);

– step 3. Apply simple pair-wise comparison matrices for each of the criteria and alternatives;

– step 4. Conduct the consistency check;

– step 5. Determine the relative weight of the components at each level.

When contrasted with the results obtained through the use of the other method, it has been demonstrated that the findings obtained through the use of the proposed strategy have accurate value. In order to determine its outcomes, it makes use of both a statistical model and a newly developed automated procedure. The price of petroleum goods is being constrained by the current study, which is using the five fundamental factors. This makes use of a PDS method and includes three basic stages in addition to five fundamental criteria. In addition, it is restricted to academic research only. The most significant shortcoming of this investigation is the fact that it requires the collection of data relating to crude oil. There were a number of challenges that needed to be conquered while utilizing the super decision program to perform an analysis on the data that was supplied. In addition to collecting the information from a reliable source, this is also very important. In light of this, novel approaches need to be incorporated into the process of cost estimating.

For a machine selection problem, [16] AHP can be used. Machine tool alternatives to a manufacturing organization's manufacturing strategy were calculated using AHP and ANP (Analytic Network Process) by [17]. For the machine tool selection problem, [18]. Therefore, proposed a fuzzy AHP solution using fuzzy logic has been analyzed and explained accordingly.

As far as the author of the study [19] is aware, Priorities have never been evaluated using decision-making process based on quantitative comparisons of these methodologies.

The "decision making process that uses a thorough analysis of the energy system" takes into account the full range of potential outcomes, including both immediate and long-term consequences, associated with a given technology's implementation. The installation of increased electrical heat demand in the heating sector, for instance, affects both electricity generation and the capacities that are needed in the electricity sector. This is the case because of the feedback loop between the two industries. The prices of the ESA are based on a model of the energy system in Germany. This model was chosen since the energy system in Germany has a diverse array of technologies already installed, which is necessary for the comparison. The energy infrastructure of Germany in 2015 is based on a model that was established in collaboration with the projects.

It's impossible to say that one strategy is superior to another, although some techniques are more suited to some types of choice issues than others. These approaches have the advantage of taking into account both monetary and non-monetary effects. One of the most prominent scoring models is the analytic hierarchy process (AHP) [20], which is among these methods. Before picking a suitable MCDM approach to address the issue at hand, it is critical that all aspects of the MCDM situation be thoroughly developed [21]. Method selection should be deferred until the analyst and decision makers have a clear picture of the problem, including all viable options and possible outcomes as well as any inconsistencies in the criterion and the amount of data uncertainty. AHP and Fuzzy AHP are MCDM approaches that use the same evaluation scale and preference functions on the criterion basis to perform evaluations for equipment selection problems. One of the most critical aspects of making an informed decision is determining the best way to define different preference functions for the various criteria. Different preference functions can be defined, unlike other ranking systems in the literature.

Therefore in the conclusion of the previous studies the implementation of the noisiceD making along with Analytic hierarchy process (AHP) approaches were employed to assess the petroleum products using ng statical model.

3. The aim and objectives of the study

The aim of the study is to investigate Decision Making in conjunction with AHP Approaches in the Evaluation of Petroleum Products Based on Statistical Models.

To achieve this aim, the following objectives are accomplished:

– to assess the first refinery phase using AHP;
– to investigate products of the raw oil;
– to study the output of the refinery process.

PDS, which includes the extraction of crude oil as one of its components. The second level is a sub-criteria that is regarded to be part of Crude oil. This level comprises ingredients such as gasoline, white oil, and other similar components. As can be seen in Fig. 1, the third level is currently being investigated as a feasible alternative to the expenditures, which include things like cost, etc.

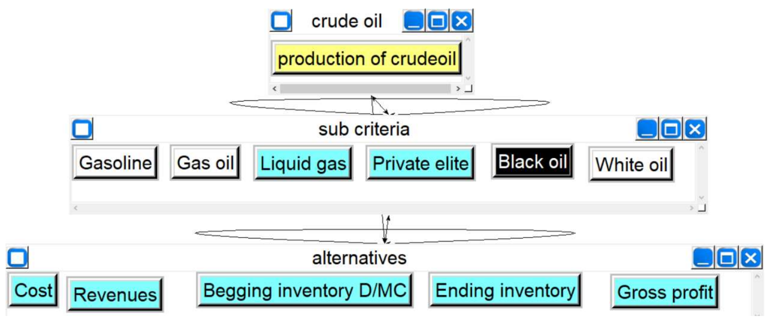


Fig. 1. Software configuration of Decision-making approach

4. Materials and methods of research

4. 1. Product design systems PDS and modeling

There have been considerations given to thoroughly investigating all three levels. The primary objective of the PDS, which also involves the extraction of crude oil, constitutes the first level of the pyramid. The second level is considered to be a sub-criteria that includes Crude oil elements such as gasoline, white oil, and so on. As can be seen in Table 1, the third level is being examined as a potential alternative to the expenditures such as cost, etc.

Table 1

Product design systems (PDS) elements

Stages	Details	Ending
first level	Production of crude oil	Goal
Second level	Elements of Crude oil	Sub-criteria
Third level	Expenses	Alternative

PDS is the abbreviation for "level description," which refers to the listing of the level as well as what it includes in the AHP. Suitable adjustments will be made to the software to accommodate these values.

The model that has been considered to carry out the results is as follow:

$$D_1=F(n_{1,2,3,4..})+I(m_{1,2,3..}),$$

where the functions F are polynomial functions of one or several variables. The functions are also polynomial. The AL-DORA Refinery industry in Iraq was where the data for this report was collected and presented , and it is from there that it has been provided. In order to achieve the statistical description, these data will be evaluated by employing the statistical model that was covered earlier in this conversation.

4. 2. Configuration of the boundary condition

There has been some discussion on the possibility of examining all three levels in great detail. The first level of the pyramid is comprised of the fundamental purpose of the

The configuration of the decision-making process has been divided into three distinct levels for ease of understanding. The first stage consists of achieving a goal that is symbolized by crude oil, Alternatives and supplementary criteria.

The data collected from the AL-DOURA refinery's operations was assessed using a decision-making technique in order to select the product that offered the most value for cost. The super decision software will be employed to asses the Sensitive plot of the alternatives.

5. Results of the noisiceD making along with analytic hierarchy process AHP approaches in the assessment of the petroleum products based on the statical model

5. 1. Assessment of the first refinery phase using Analytic Hierarchy Process AHP

The Doura refinery of the central oil companies' refineries has two stages of refining and produces a variety of products . It will choose the first stage of refining as a model for separating the joint costs at the point of separation, which is different from the approach employed in the refinery where the joint costs are distributed (the method of physical production units). With this technique of distributing, the waste will also be charged with forming costs, since the waste is generated at the end of each stage and so bears all of its own expenses. Adding it just to the cost of materials distorts the costs that are collected from the Doura refinery industry, as illustrated in Table 2.

Table 2

The amount of the joint costs represented in the materials and costs of formation will be calculated

Cost	Values
Raw Material	311645046005 IQD
Operating Expense	85301329702 IQD
Total cost	396946375707 IQD

The analysis may be carried out in one of three steps, which have all been proposed for consideration. In the first stage of manufacturing, the cost of joining is included in, whereas in the second stage, the cost of raw materials, operating expenditures, and other expenses are factored in. the very last phase, which is considered to have incorporated the whole assessment in its entirety. The evaluation that is depicted in Fig. 2 has been carried out making use of the AHP approach.

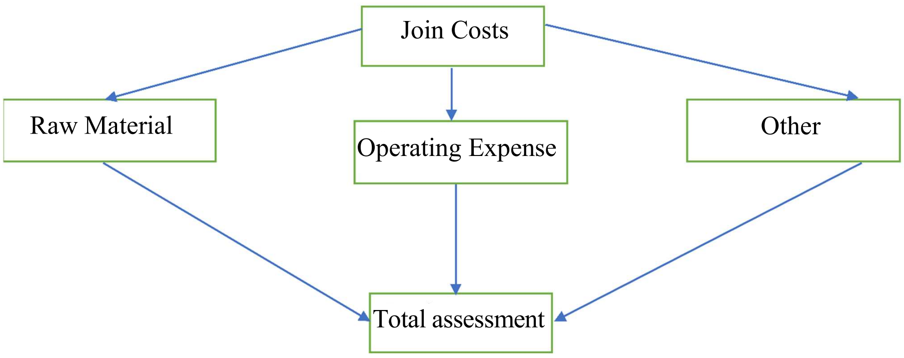


Fig. 2. The main elements based on the Product design systems PDS arrangement

There were three steps that were presented and spoken about in accordance with the product design systems; the first stage involves the costs of connecting. The raw materials, the costs of cultivation, and any other important concerns make up the basic components of the second stage, which is comprised of these three primary components. At the end of it all, each and every one of these will be rated according to their respective standards.

5. 2. Product of the raw oil using AHP approach

There has been a substantial amount of discussion on whether or not it is desirable to use these five metrics as the major indications of the output of the project (Gasoline White oil, Gas oil, Diesel fuel, Black oil, Liquid gas, Private elite). Gas oil has overtaken all other options to become the top choice since it generates 10^5 in revenue and 10^6 in cross profit. This has caused it to outperform all other alternatives. As a result of this, it has surpassed all of the other possibilities and become the best option. In addition to this, the quantity of gas oil that was in inventory at the beginning of the period was $5*10^6$, and the quantity of gas oil that was in inventory at the end of the period, as indicated in Table 3, was 10^6.

In Fig. 3, it is possible to find a graphical representation of the final set of criteria, which is also sometimes referred to as the alternatives. These choices take every factor into consideration, including the fowling, the revenues, the expenses, the inventor's begging, and the gross profit. According to the conclusions of the study, one should not put their faith in the begging inventor because its score might fall anywhere between 0.2 and 0.9 at any one time. On the other hand, the points awarded for the other choices can be anywhere from perfect to zero. This shows that the begging inventor should not be depended upon in any way, and one should avoid doing so. The following chart has been generated based on the output of the super-decision software.

When it comes to the strategies that are the most effective, it is possibel to separate them into three distinct categories: the first category will include cost and income, and the second category will include benefits and drawbacks. The third category will include the strategies that are the most effective. The ranking system as a whole places it in the third position overall due to its value of around 0.95 as well as the fact that it occupies the third position on the normalized alternative axis. As can be seen in the illustration, another group, this one comprising the starting inventor, the completing inventor, and the gross profit, has been centered on the axis between the numbers 1 and 2, and the numbers 1 and 2 may be found between the numbers 1 and 2 as shown in Fig. 4.

It has been shown that the alternative plot that is referred to as the Ideal Sensitive better shows the optimal location of the major parameters along the Y-axis. This discovery was made. Figure four shows the best option for the main parameters

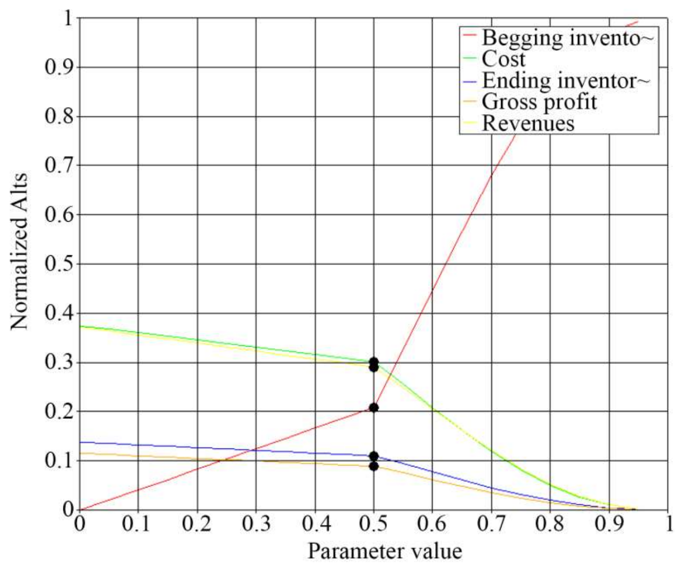


Fig. 3. Sensitive plot of the alternatives

Table 3

The production of the Raw oil

Out Put	Revenues(IQD)	Cost (IQD)	Begging inventory D/MC (IQD)	Ending inventory (IQD)	Gross profit (IQD)
Gasoline	016509451282	61129741858	444620361	2045315346	656676445812
White oil	34027250000	53914404733	502605374	103037617	283199627
Gas oil	10500930817610	82271115385	749269215	1015673734	10442876529840
Diesel fuel	0003292037	4882030615	57532809	068130213	1138114129
Black oil	152621220000	173465566183	8356408773	4084126836	21705211294
Liquid gas	7424025157	1190839127	624823602	001189557	6235820201
Private elite	3570000	793892	–	–	8016772

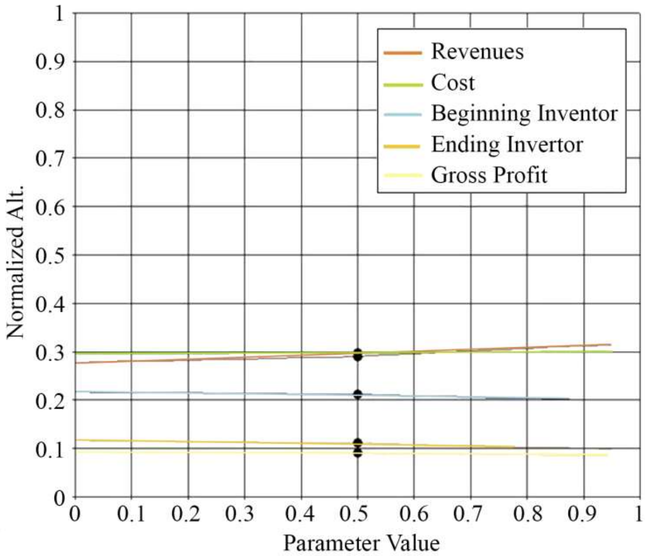


Fig. 4. The Ideal Sensitive plot of the alternatives

accomplished by acquiring the value 0.0905 as the result of this attempt. If you want to be the best available option it is necessary to make sure that the cost is set to 1, which is the number that is deemed to be optimal. Only then will you be able to compete effectively with the other choices. According to Fig. 5, the number 2.973 is judged to be within the usual range.

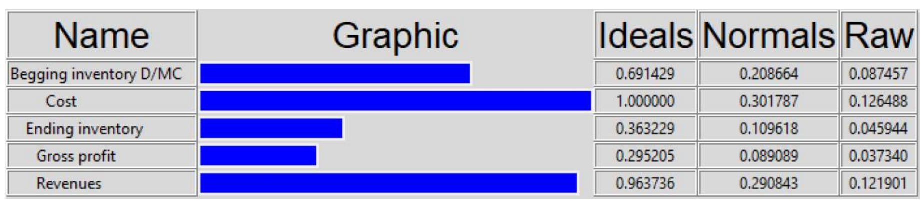
The maximum conceivable value for the first property is 0.975, while the best possible value for the second property, which is used for Revenues, is 0.2900. Both properties are considered to have equal potential. Both of these properties are rented out, but for entirely separate reasons.

In terms of the raw values of the, the value of the cost is 0.124155, while the value of the income is 0.121130. Both of these values can be expressed as percentages. In the process of analysis, these two numbers will become apparent.

It will be necessary to have a total of five separate sections in order for the parameter that was ultimately selected to function effectively. Some of these sections must have inventories and other sections that are comparable to these types of sections. These metrics were examined by taking into account the three unique types of data, which are referred to as ideal data, normal data, and raw data, respectively.

5. 3. Output of the refinery process

When loading trash with forming costs and materials, the combined costs were computed in Table 4 by taking into account that they are discharged at the conclusion of each stage and are not addressed by adding common expenses. Consequently, the issue of dumping trash at a lower price than its true value was addressed. Data has been collected for ALDOURA refinery industrial.



Name	Graphic	Ideals	Normals	Raw
Begging inventory D/MC		0.691429	0.208664	0.087457
Cost		1.000000	0.301787	0.126488
Ending inventory		0.363229	0.109618	0.045944
Gross profit		0.295205	0.089089	0.037340
Revenues		0.963736	0.290843	0.121901

Fig. 5. The overall process of the final selected parameter

Table 4

The output of the refinery process

Out put	Quantity (Litre)	Price (IQD)	Sales (IQD)
Gasoline	1485025819 L	190000 D/L	282154905610000 D/L/1000= =282154905610D/MC
White oil	272218880 L/1000= =272218 m^3	125000 D/MC	34027250000D/MC
Gas oil	1500134937 L *0.5565= =834824.571	70000 D/TON	5843768000000 D/Ton/0.5565= =10500930817610D/MC
Diesel fuel	137791154 L/1000= =137791 MC	53000 D/MC	7302923000 D/MC
Black oil	2543687276 L/1000= =2543687 MC	60000D/MC	152621220000D/MC
Liquid gas	59021.802 Ton	70000 D/Ton	4131470000 D/T/0.5565= =7424025157 D/MC
Private elite	17586 L/1000= =17.586 MC	210000 D/MC	3570000 D/MC

The aggregate of the three estimated values will decide the value of the other optional parameter, which you may or may not choose to make use of (Idaels, Normals, and Raw). The application of a computer program that assisted with decision-making was what made it feasible to choose the most qualified Parmenter for the job. According to the findings of the study, out of all of the many variables that should be taken into consideration, the cost should be given the utmost importance. The last opportunity to acquire a value for the Gross profit was offered, and the goal was

6. Discussion of the decision making along with analytic hierarchy process AHP approaches in the assessment of the petroleum products based on the statistical model

This analysis of the refinery's first phase utilizing the analytic hierarchy process (AHP) is based on the findings of the most recent research and is depicted in Fig. 1. The purpose of this analysis was to select the optimal strategy. Additionally, research was conducted on the Table 3 goods that were made from raw oil. Fig. 5 also provides an accurate description of the final products of the refining process.

When compared to the alternative method, it has been shown that the results obtained utilizing the proposed strategy have precise value. [22] It uses a statistical model and a brand new automated technique for its calculations.

Based on these five fundamental characteristics, the current study is limiting the price of petroleum products. This employs a PDS method with three core phases and five basic criteria. As an added downside, it can only be used for research.

The most significant limitation of this study is that crude oil data had to be collected. Several challenges arose while attempting to analyze the offered data with the aid of the super decision program. Furthermore, it was obtained from a reliable source. Therefore, it is necessary to implement novel approaches to the estimation of costs.

7. Conclusions

1. The Analytic Hierarchy Process Used in the Evaluation of the First Refinery Phase The AHP was carried out utilizing the data form. The Doura refinery, which is connected to the central oil firms, features two stages of the refining process and produces a number of different goods.

2. Product of the raw oil has been estimated using AHP approach . There has been significant debate regarding the desirability of using these five metrics as the primary indications of the output of the project (Gasoline White oil, Gas oil, Diesel fuel, Black oil, Liquid gas, and Private elite). Gas oil has surpassed all other alternatives to become the top choice because it generates 10500930817610 in revenue and 10500930817610 in cross profit.

3. It has been determined what the output will be from the refinery's operation. Through the process of calculating the total costs of the waste, which involved loading them with the forming costs in addition to the materials as they were discharged at the conclusion of the stage, the combined costs of the waste were determined.

Conflict of interest

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this paper.

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