
ANALYSIS OF BUYING DECISION MAKING IN THE NON-SUBSIDIZED FUEL MARKET IN INDONESIA USING A SOFT SETS APPROACH

Slamet Harianto¹⁾, Ginta Ginting²⁾, Rini Yayuk Priyati³⁾

¹⁾Student of Doctor of Management Science Program, Universitas Terbuka, Indonesia

²⁾Management Study Program, Universitas Terbuka, Indonesia

³⁾Development Economic Study Program, Universitas Terbuka, Indonesia

Corresponding author: khoslamet.harianto@gmail.com

Abstract

The non-subsidized fuel market in Indonesia is very unique, because many world players who are successful in their own countries and successful in other countries fail in Indonesia. One example is that Petronas, which was successful in Malaysia and other Asean countries, has failed in Indonesia. An interesting phenomenon is that BP, in its marketing, cooperates with local player AKR in marketing its products against Pertamina's heavy players. This article will analyze consumers' buying decisions for non-subsidized fuel based on N-Soft Sets, where the object to be analyzed is in the form of non-subsidized fuel brands in Indonesia with the parameters measured being price, quality, location, brand and loyalty. The algorithm that will be used is the Extended Weight Choice Values Algorithm with a single decision type, namely the decision to buy non-subsidized fuel. Weighting of the parameters will be given according to the hierarchy of needs in Maslow's Hierarchy theory, starting from the lowest are physiological needs, security needs, social needs, ego needs and self-actualization needs as the highest level, and Marketing Mix Theory. By implementing N-Soft Sets, it can overcome problems in decision making both in binary and non-binary form so that decision making can be determined in the form of numbers, words or symbols and other forms. A deeper discussion regarding the decision to purchase non-subsidized fuel markets will be able to provide a reference for how consumers choose products for unique markets so that they can be used as a reference when entering a unique market.

Keywords: Non-subsidized fuel, Purchase decision, Soft sets

Introduction

The non-subsidized fuel market in Indonesia is the fuel used by consumers by purchasing it using the reference price of the world oil market. In Indonesia alone there are 2 (two) types of fuel being sold, namely:

1. Subsidized fuel, namely fuel whose price is determined by the Government by providing price subsidies intended to support cheap shipping costs through the sale of diesel-type oil at affordable prices and helping micro and small businesses by providing Premium and Peralite gasoline prices at lower prices. cheaper than market price. This type cannot be used for industrial purposes and passenger cars with the luxury category.
2. Non-subsidized fuel is fuel that is sold in Indonesia using market prices where the Government does not regulate the selling price. The selling price for this type in Indonesia uses the MOPS (Median Oil Price Singapore) reference and is valid for 14 days, so the price changes on the 1st of the current month and the 15th of the current month.

There is an interesting phenomenon in the non-subsidized fuel market in Indonesia, where foreign players are successful and successful in their country of origin and many other countries fail in Indonesia. For example, Petronas dominates the market share in its home country Malaysia and is successful in other Asean countries except in Indonesia. In Indonesia, Petronas in 2012 closed 19 of its filling stations and declared that it would no longer operate in Indonesia. So since operating from 2006, Petronas has only been able to survive 6 (six) years in the Indonesian market.

This was followed by the Total brand which started to enter the non-subsidized fuel market in 2009 ending tragically by selling 18 gas station outlets in 2020 and selling them to VIVO. It is known that TOTAL is a large oil company in France and has successfully marketed its products in Europe, even in Singapore. Currently the brands that are still operating in Indonesia in selling non-subsidized fuel oil in Indonesia are Pertamina, Shell, BP-AKR, Vivo and Mobil.

This article discusses the buying decisions of customers in Java Island because apart from Pertamina, most of the sellers operate on Java Island so that a more precise analysis will be obtained. The analysis will use the N-Soft Sets method initiated by Fatia Fatima (2018), and the variables that will be used to analyze are sales locations, brands, quality, price and loyalty.

An analysis of the decision making of non-subsidized fuel buyers in Indonesia will use the N-Soft-sets method because Fatia Fatimah (2018) provides a forum for decision making in the form of numbers, words, forms or sentences, so not only in binary form but also in non-binary form.

Definition of Soft Sets

Soft set is a generalization of [fuzzy set theory](#) proposed by Molodtsov (1999) with the aim of dealing with uncertainty parametrically. Soft sets are a family of parameterized sets - intuitively, they are called soft because the limit of the set depends on the parameter. In formal language, the soft set of universal set X and parameter set E is [the pair](#) (f, A) where A is [a subset](#) of E , and f is [a function](#) from A to a set of powers X . For every e in A , the set $f(e)$ is called the set of values e in (f, A) .

N-Soft Set and Decision making

Fatia Fatimah (2018) introduces the N-soft set model as the development of a soft set model that addresses problems in decision making in both binary and non-binary forms of closed intervals and non-binary N-arrays so that decision making can be determined in the form of numbers, words or symbols. and other shapes. The definition of N-Soft Set according to Fatia Fatimah (2018) is as follows:

N-Softs set on $U, (F, A, N)$ is a way of describing the value $F: A \rightarrow 2^{U \times R}$ where in each $a \in A$ there will be an ordered pair $(u, r_e) \in U \times R$ such that $(u, r_e) \in F(e) \in U, r_e \in R$.

U = collection of sellers of non-subsidized fuel oil.

F = Mapping will be A

A = set of parameters in the form of sentences, namely sales location, brand, quality, price and loyalty to U .

In the analysis of decision making in N-Soft Sets, Fatia Fatimah (2018) suggest several algorithms, namely extended choice values, extended weight choice values and T-extended choice values. In this article, the algorithm that will be used is the extended weight choice values algorithm as follows:

1. Input a set of objects $U = (u_i, i=1, 2, \dots, m)$, with its parameter set $A = (e_j, j=1, 2, \dots, n)$ and weighted $w_j \in (0, 1)$ for each j
2. Input N-Soft Set (F, A, N) , with $R = (0, 1, \dots, N-1), N \in (2, 3, \dots)$ so we get $\forall u_i \in U, e_j \in A \exists! r_{ij} \in R$.
3. For each u_i calculate Extended Weight Choice Values ie $\sigma_i^w = \sum_{j=1}^n w_j r_{ij}$
4. Determine the type of decision as follows:
 - i) If the decision is single, then find $k, \sigma_k^w = \max(\sigma_j^w)$ resulting in u_k being the most optimal choice object. If there is more than one k index, then any object from k can be chosen by the decision maker.
 - ii) If the decisions are multiple, then sort u_i based on the value σ_i from the highest to the lowest value and the objects and recommendations on the objects are in accordance with the order of u_i .

The system of selling non-subsidized fuel at fuel stations Public (gas stations)

Sales of non-subsidized fuel in Indonesia have the following characteristics:

1. Location, in terms of the location of the 5 brands analyzed, there is a very large gap, where Pertamina has 3,434 places, SHELL has 79 places, BP-AKR has 78 places, Vivo has 18 places. while Mobil has 2,100 places but in the form of Mini Stations. The difference between Gas Stations and Mini Stations is that Gas Stations have a minimum location of 2,000m² on the Provincial Highway and have filling stations with more than 6 filling pumps. Whereas Mini Stasion only has an area of 100m² with only 1 filling pump.
2. The set price has a pattern that the selling price of Pertamina \leq the selling price of SHELL, BP-AKR, VIVO and Mobil.
3. Most Promotion programs are carried out by SHELL. BP-AKR and Mobil.
4. Changes in the selling price are determined by world oil prices with reference to using MOPS (Median Oil Price Singapore)
5. The quality and type of fuel sold for each brand is different from Pertamina, which has the most variations, and Mobil has only 1 variant.

Table 1. The complete gas station data in Java Island

brand	Number of gas stations	type	Fuel type	Price(Rp/Liter.)
Pertamina	3,434	Fuel	- Peralite(RON 90)	10,000
			- Pertamina (RON 92)	14,500
			- Pertamina Turbo (RON 98)	15,900
		Solar	- Dexlite	17,100
			- Pertadex	17,400
Shell	79	Fuel	- Super(RON92)	15,420
			- V Power(RON 95)	16,139
		- V Power Nitro (RON 98)	16,510	
Solar	- V Power Diesel	18,310		
BP-AKR	78	Fuel	-BP 90 (RON 90)	14,890
			- BP 92 (RON 92)	14,990
			-BP 95 (RON 95)	16,130
		Solar	- BPDIESEL	17,990
VIVO	18	Fuel	- Revvo 89 (RON 89)	10,900
			- Revvo 93 (RON 92)	15,400
			- Revvo 95 (RON 95)	16,100
Mobil	2,100	Fuel	- Car 92 (RON 92)	14,600

BPH-Migas data for 2022, and prices based on September 15, 2022.



Pertamina's Gas Station



Shell's Gas Station



BP-AKR's Gas Station



Vivo's Gas Station

Figure 1. The Outlook of the Gas Stations



Figure 2. The outlook of Mini Stasion

Methods

Weighting Variables

The variables to be weighted are seller location, brand, quality, price and loyalty where the weighting is determined based on the 4P marketing mix perspective (place, product, price and promotion) as follows:

Place

Dave (1996) defines location as a direct or indirect channel to the market where the provision of access considers things that can provide convenience to customers. In the field of marketing, the decisions taken in terms of location are one of the strategies for intensive, selective and exclusive distribution. In addition, the location is also related to transportation, warehousing and logistics. When determining the location of selling non-subsidized fuel, the consumer context is an important element of marketing and easy for customers to get their products.

Product

In this marketing mix element, which is categorized as a product is brand and quality variables. Dave (1996) defines the product as a reference to goods that can meet the needs and or desires of both tangible and intangible customers. In the field of product marketing includes: design, brand, packaging, service, quality and how to manage the cycle of the product.

Brand

According to Kotler (2003) a brand is a name, term, sign, symbol, design, or a combination of part or all with the intention of providing an identity for the goods or services being sold so that they can be distinguished from goods or services from competitors. Meanwhile, Alycia Perry (2003) argues that a brand is a promise of the quality of goods produced which forms the relationship between producers and consumers. From the description above, it can be summarized that the meaning of a brand is a sign, image, symbol, name, word, letters, numbers, arrangement of colors or a combination of these elements that can distinguish goods produced by a company that differ from goods produced by other companies, through the advantages of each product so as to improve the relationship between buyers and producers through the psychological side.

Quality

According to Kotler and Keller (2009) an assessment of the quality of an item can be measured by:

1. The performance of the quality, namely the extent to which the level of the characteristics of an item when it is used. With different levels of quality, it will be able to distinguish each manufacturer to produce goods with the highest quality and the lowest possible price. The quality levels are low, medium, high and average.
2. Conformity of quality, every consumer who will buy goods always expects to get goods with quality according to what is stated in the technical specifications.
3. Durability, the durability of a product is a measure of the age of the item used both in normal and extreme conditions.
4. Reliable, namely the probability of an equipment to be able to function according to the desired specifications with certain conditions and time without being damaged.

According to Feigenbaum (1986) the quality of goods is an item that is in accordance with what is expected by the buyer. From the definitions above, it can be summarized that the meaning of the quality of an item is an effort to make an item in accordance with predetermined quality standards or in accordance with changing conditions and consumer expectations for the item with the aim of meeting or even exceeding the expectations of the buyer.

Price

Dave (1996) defines price as a reference to the amount paid by customers for a product, where price can also be a customer's expectation in obtaining a particular product. In the field of marketing, what covers price is the pricing strategy either through discounts or payment terms.

Promotion

Frederick F. (2001) explained that in the marketing mix the company will try to gain growth and retain its customers through promotional activities by providing incentives or strengthening its brand in marketing its products. Dave (1996) defines promotion as a reference for a marketing communication that contains elements of advertising, public relations, sales promotion and direct marketing. In promotional activities, the delivery of the message to be sent to customers must be clear and reachable by the target audience.

Weighting Process

The process of weighting the variables analyzed is based on decision making by the buyer which according to Maindoka (2014) is a condition in which the buyer makes a decision or action to buy or not. And Pradipta (2016) states that the purchase decision is the final decision that the buyer has to make purchases of goods or services based on several considerations. Factors that can influence buyers in making buying decisions can be individual (internal) or environmental (external).

Internal factors

According to Engel (2006) the factors that influence internally are:

- a. Resources owned by consumers (eg money, time etc.)
- b. Interest in the stimulus received

External Factors

Influential external factors are as follows:

- a. Culture → refers to the values, ideas and symbols that influence what products are selected.
- b. Social class → division of society based on the same behavior, interests and values. Class differences show different behavior.
- c. Groups → are connected by the same tribe, type of business, region etc.

From the explanation above, the decision to buy non-subsidized fuel will be more influenced by internal factors than external factors.

Variables that can be classified as internal factors are location and price while factors that can be classified as external are brand, quality and loyalty. While the weighting value of all variables must be 1 (one) as follows:

- i) The sales location gets a weight of 0.35, because if it is not in that location, the consumer cannot choose it
- ii) Price gets a weight of 0.3, because if there is a choice, then fuel consumers in Indonesia will choose the cheap one
- iii) Quality gets a weight of 0.2 because if there is a location, the price is the same, then new consumers will see quality
- iv) The brand gets a weight of 0.1 because the fuel brand for Indonesian people has not been a significant decision-making element.
- v) Loyalty, gets a weight of 0.05 because it is the weakest element in decision making

Application of N-Soft Sets in decision making

In accordance with the explanation above, N-Soft Sets will be applied in analyzing the decision making of consumers of non-subsidized fuel oil in Indonesia because the analysis of decision making is based on verbal data on the variables Sales Location, Brand, Quality, Price and Loyalty. Then $U=(u_1, u_2, u_3, u_4, u_5)$ which is a set of non-subsidized fuel sellers in Indonesia, namely: Pertamina, Shell, BP-AKR, Vivo and Mobil, while $A=(a_1, a_2, a_3, a_4, a_5)$ which is the set of location, brand, quality, price, and loyalty parameters. N-Soft Sets (F, A, N) describes the most successful fuel seller in Indonesia, which is obtained by $(F, A, N) = (\text{vendor location} = (u_1, u_2, u_3, u_4, u_5), \text{seller brand} = (u_1, u_2, u_3, u_4, u_5), \text{seller quality} = (u_1, u_2, u_3, u_4, u_5), \text{seller price} = (u_1, u_2, u_3, u_4, u_5), \text{loyalty to the seller} = (u_1, u_2, u_3))$. It is described that Mr. "Budi" is someone who wants to buy non-subsidized fuel with the parameters of the seller's location, price and quality, which are part of set A. Whereas

Mr. "Eko" is someone who wants to buy non-subsidized fuel with the parameters of a location close to his house and cheap prices and Mr. Yandi wants fuel that is close to his house and of good quality.

To overcome the different problems of buyers' desires for non-subsidized fuel, the N-Soft Sets decision maker's analysis is used as follows:

Table 2. N-Soft Sets (F,A,N)

(F,A,N)	a 1	a 2	a q
u 1	(r 11)	(r 12)	...	(r 1q)
u 2	(r 21)	(r 22)	...	(r 2q)
...
u p	(r p1)	(r p2)	...	(r pq)

Fatimah et al (2018)

Tabular creation of N-Soft Sets

U is a set of fuel sellers with the following identities:

1. Pertamina (u₁)
2. BP-AKR (u₂)
3. SHELL (u₃)
4. VIVO (u₄)
5. Mobil (u₅)

While the set of parameters is as follows:

1. Price(a₁)
2. Quality (a₂)
3. Point of sale (a₃)
4. Brand (a₄)
5. Loyalty (a₅)

The value of r is the influence of the parameter on the brand and is based on numbers 1-5, where the number 1 indicates that the effect of a_q is very weak on u_p, while the value 5 has a very strong effect on u_p. The determination of the numbers 1-5 is given based on data from table 1, so the value of r is obtained as follows:

Table 3. The Value of R

U/A	Price	Quality	Location	Brand	Loyalty
Pertamina	3	3	5	5	1
BP-AKR	3	4	2	3	1
SHELL	3	4	2	4	1
VIVO	3	2	1	2	1
Mobil	3	1	3	2	1

In table 3 the value of r_{pq} shows the following relationship:

- i. Price, the effect on the seller has the same value because the prices are set can be said to be the same or slightly different so that the effect on the seller is almost the same.
- ii. Quality is assessed from the number of types sold and opinions from buyers regarding the performance of these fuels in the use of their vehicles. BP-AKR and SHELL get the highest score because the type sold is almost the same as Pertamina's completeness but excels in user comments that BP-AKR and SHELL are more responsive to vehicle usage and the liter size the buyer feels is a bit more from Pertamina (source: comments comments on Google). The Mobil gets the lowest value because Mobil only sells 1 type, while Vivo only sells gasoline.
- iii. Location is a very influential factor because the business model of gas stations is that consumers come to the seller's location to buy and get the goods where the products purchased cannot be delivered but can be picked up. From BPH-MIGAS data it appears that Pertamina has the largest number and is located on provincial-class roads while Mobil, although there are many outlets, use the strategy on district-class roads so that they are given an assessment of 3. The smallest is VIVO because the number of outlets is only 18.

- iv. Brands at Pertamina have a very strong influence because they have been in operation for a long time and belong to the State, while Shell is due to active advertising and has been operating longer than BP-AKR, VIVO and Mobil, so it has an advantage.
- v. Loyalty, this parameter is considered to have a less strong influence because the gas station business has the greatest influence on how the product is obtained in accordance with the presentation of Engel (2006) which illustrates that internal factors will have more influence than external factors when applied to the gas station business.

From table 3, the N-Soft Sets tabulation is made as follows:

Table 4. The N-Soft Sets Tabulation

U/A	(a ₁)	(a ₂)	(a ₃)	(a ₄)	(a ₅)	Σ
(u ₁)	3	3	5	5	1	17
(u ₂)	3	4	2	3	1	13
(u ₃)	3	4	2	4	1	14
(u ₄)	3	2	1	2	1	9
(u ₅)	3	1	3	2	1	10

Analyze decision making using the extended weight algorithm choice values. The parameter weighting used is as described above, namely:

- i. Price(a₁) the weight value(w₁) = 0.3
- ii. Quality (a₂) weight value (w₂) = 0.2
- iii. Location (a₃) has a weight value (w₃) = 0.35
- iv. Brand (a₄) weight value (w₄) = 0.1
- v. Loyalty (a₅) has a weight value (w₅) = 0.05

The calculation of Weight Choice Values(WCV) is as follows:

$$WCV \text{ on } u_p = r_{pq} \times w_q$$

The Weight Choice Values (WCV) tabulation is as follows:

Table 5. The Weight Choice Values

u / r × w	r _{p1} × w ₁	r _{p1} × w ₂	r _{p3} × w ₃	r _{p4} × w ₄	r _{p5} × w ₅
u ₁	wcf ₁₁	wcf ₁₂	wv ₁₃	wcf ₁₄	wcf ₁₅
u ₂	wv ₂₁	wv ₂₂	wcf ₂₃	wcf ₂₄	wcf ₂₅
u ₃	wv ₃₁	wcv ₃₂	wcv ₃₃	wv ₃₄	wcf ₃₅
u ₄	wcf ₄₁	wcf ₄₂	wcf ₄₃	wcf ₄₄	wcf ₄₅
u ₅	wcf ₅₁	wcf ₅₂	wcf ₅₃	wcf ₅₄	wcf ₅₅

Then the WCV value obtained is as follows:

Table 6. WCV Value

u / r × w	r _{p1} × w ₁	r _{p2} × w ₂	r _{p3} × w ₃	r _{p4} × w ₄	r _{p5} × w ₅	Σ
u ₁	0.9	0.6	1.75	0.5	0.05	3.8
u ₂	0.9	0.8	0.7	0.3	0.05	2.75
u ₃	0.9	0.8	0.7	0.4	0.05	2.85
u ₄	0.9	0.4	0.35	0.2	0.05	1.9
u ₅	0.9	0.2	1.05	0.2	0.05	2.4

From table 6 it appears that the decision to buy fuel oil by customers has a significant sequential effect as follows:

- i. Location has the most significant influence because the difference between the highest weight (1.75) and the lowest weight (0.7) has the highest gap 1.05. This causes a significant difference in the WCV of each brand as evidenced by the following points:

- a) Pertamina which has the highest value shows that the decision to buy it has the highest number.
- b) Mobil that have the lowest quality because Mobil only sells 1 type of fuel and even it's brand more unknown but Mobil has total WCV that closely to the Shell's and BP-AKR's total WCV.
- ii. Quality occupies the second effect because the difference between the highest weight (0.8) and the lowest weight (0.2) has gap 0.6 . This is supported by several things as follows: Mobil that has 2,100 locations in the total WCV value are still inferior to Shell and BP-AKR which have almost the same locations, namely 79 and 78 units, but the difference in total WCV is not large because the location factor is the most dominant factor in influencing buying decisions .
- iii. Brand has the third influence because the difference in the highest weight (0.5) and the lowest weight (0.2) has gap 0.3 which is more smaller than Location's and Quality's Gap.

Price and loyalty have no significant sequential effect , because the gaps between the brands is 0.

Results and Discussion

Decision-making analysis using the N-Soft Set proposed by Fatia Fatimah (2018) is a very useful and precise tool for analyzing a phenomenon that occurs based only on data that is appropriate to the context under study. If the parameters used are adjusted to the related theory, then when evaluating the parameters, the numbers obtained will be able to reflect the actual situation.

It appears that the parameters used above are adjusted to the 4P marketing mix theory and decision-making theory, so the final analysis results reflect the actual situation. It can be seen that Pertamina gas stations when viewed from the purchase queue occupy number 1, while number 2 is Shell and number 3 is BP-AKR, while for the Vivo and Mobil brands it can be seen that the gas stations often look empty from the queue of buyers . this corresponds to the WCV value listed in table 6. For this reason, the application of N-Soft Set cannot be separated from theories that are appropriate to the context being analyzed, without involving existing theories that are appropriate to the context will cause bias in the future. evaluate the parameters and perform the decision-making algorithm.

Conclusion

The application of the N-Soft Set in decision-making analysis will provide valid and reliable results when evaluating the parameters and algorithms based on the theory that is appropriate to that context. In addition to theory, the data used as material for analysis must also be obtained from appropriate and credible sources, this is very important because if the data used is non-credible data, then the assignment of values to the parameters and decision algorithms will also not be credible.

The limitation in this article is that the results of the analysis do not use survey data on customers who buy non-subsidized fuel, for that it is hoped that further research will be carried out using survey data for fuel buyers and has hypotheses that support the results of the algorithm. Besides that, this article only uses the WCV algorithm, where Fatia Fatimah (2018) presents several choices of algorithms that can be used to compare whether the results will match.

References

- Engel, Blackwell, Miniard, 2006, *Consumer Behavior*, Binarupta Aksara, Jakarta
- Fatia Fatimah. 2018. *Decision Making Incomplete N-Soft Sets on Data to Measure Indicators of Sustainable Development Goals*. Open University
- Fatia Fatimah. 2018, Rosadi D, Judge RF & Alcantud JCR 2018. *N-Soft Sets and Their Decision Making Algorithms*. *Soft Computing*. <http://rdcu.be/v6yf>.
- Fatia Fatimah. 2021. *Data Analysis and Interpretation*. Open University
- Feigenbaum and Vallin Armand., 1986, *Total Quality Control, 3rd*. McGraw-Hill Book Inc, New York .
- Kotler, P, 2003, *Marketing Management*, 11st, Gramedia, Jakarta
- Kotler P and Keller Kevin Lane, 2009 . *Marketing Management* . 12nd, Pearson International Editions, USA
- Maindoka, Raiza, 2014 , *Brand Image and Perceived Quality on Consumer Buying Decision of Samsung Mobile Phones*, Economic Journal Vol 2
- Molodtsov, DA 1999. "Soft set theory—First results . *Computers & Mathematics with Applications*. **37** (4): 19–31. doi : [10.1016/S0898-1221\(99\)00056-5](https://doi.org/10.1016/S0898-1221(99)00056-5)
- Needham, Dave (1996). *Business for Higher Awards* . Oxford, England: Heinemann
- Perry, Alicia . 2003 , *Before the Brand: Creating the Unique DNA of an Enduring Brand Identity*, McGraw-Hills . New York
- Pradipta, Dicho, Hidayat, Kadarisman et al, 2016, *The Effect of Brand Equity on Decisions Purchasing* , Journal of Business Administration, Malang
- Reichheld, Frederick F. 2001 . *Loyalty rules! : how today's leaders build lasting relationships* . Boston: Harvard Business School Press. ISBN 1-57851-205-0 . OCLC 46402012