

Agent-based Simulation of Fuel Distribution in Indonesia

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Abstract

Indonesia historically has maintained very large consumption subsidies for domestic retail fuel consumers. The Government announced that current subsidy levels could not longer to be sustained, so it will be reduced. Since fuel is usually smuggled overseas not the other way around, it causes a serious case such as illegal fuel. The poor people only enjoy 20% distribution fuel subsidy rather than rich people. Beside that, an opportunist actor does a serious case for public demand to get a large profit. Poorly, there is no clearly sanction for them. Meanwhile, it needs law enforcement to give sanction for opportunist actor. Interaction in this fuel distribution for law enforcement is very complex. In this research, we use fuel distribution model for petroleum, gasoline and diesel fuel to secure fuel distribution using agent based simulation.

Keywords: law enforcement, fuel distribution, agent-based simulation

1. Introduction

Fuel is vital both to the production sector and to the people's mobility in their economic activities but the government of Indonesia has failed to manage fuel distributions in the people's interest. Indonesia became a net oil importer in 2004. While it imports at market prices, state-owned Pertamina sells petroleum products to consumers at subsidized prices. As of April 2005, the Government owed Pertamina about \$2.6 billion in fuel subsidies, putting pressure on the company's cash flow and on its ability to pay for imported petroleum products. It has affected oil supplies to the country, which faces petroleum shortages now. Recent parliamentary delays in approving the Government's revised budget

have further delayed partial payment of fuel subsidies to the company.

Pertamina desires to handle subsidized fuel distribution in Indonesia. Since fuel is usually smuggled overseas not the other way around, it causes a serious case such as illegal fuel, shortage of fuel, the smuggling fuel, etc. For example "Indonesian warship KRI Untung Surapati-872 that patrolled Maluku waters in the eastern part of Indonesia caught tanker KM NMSC-07 which carried 100 tons of fuel oil from China recently" [4]. This case shows that fuel oil distribution in Indonesia has a big problem.

The constraint in this problem are parties which using the DISPARITAS opportunity with doing piling up activity and distribute illegal fuel to serve industry and ship, there are so many fuel base and illegal fuel trader, there is industry/ contractor that not being yet to buy a fuel from Pertamina directly, because they have got offering from illegal trader. Beside that, there is no law enforcement for opportunist actor and no same perception between institution and government to save a governmental policy to fuel subsidized.

From the above problem situation, we will see how a law can be enforced by using agent-based modeling. In this model, each party can interact with each other dynamically in fuel distribution system that is for petroleum, gasoline and diesel fuel distribution.

2. Problem of Distribution System

Indonesia historically has maintained very large consumption subsidies for domestic retail fuel consumers, with products being sold at a steep discount from world market prices. Consumption of 2005 subsidized fuel has been reduced successfully from 59.6 million Kilo Liters to only 56.4 million Kilo Liters. While the sales of fuel oil with the economic price has exceeded the target as big as 5.9 million Kilo Liters with the realization of 6.4 million Kilo Liters [5].

In fuel distribution, Pertamina implements several methods to maintain its retail outlet through zero losses fuel oil distribution and win-win solution implementation for gas stations. Pertamina has also signed the contract on fuel oil's sales with big industries purchasing fuel oil more than 100 Kilo Liters per month [5]. In here, Pertamina implements attractive marketing system.

In early September, the Government announced that current subsidy levels could not longer to be sustained, and on 1 October, raised fuel prices by percentage average of 126.6%. The government announced that the price of fuel in domestic area increase on 1 march 2006. In order to fix the fuel price, there is a DISPARITAS (the price is same with Singapore price) for a price of fuel, i.e. [7]:

- 1. petroleum for household / small business >< petroleum for industry
- 2. petroleum for household / small business >< premium
- 3. petroleum for household / small business >< diesel fuel

However, the government still gives subsidy for weak people who do not have money with case program (BLT). In practice, this program could not been seen clearly. The constraint in fields, i.e. [7]:

1. Some actor act opportunist to do an illegal and distribute to industry and ship.
2. There are so many illegal oil base and trader
3. There are some industry/ contractor and company, which not been bought a fuel to Pertamina, because they receive offering from illegal trader.
4. There is no explicit law for the actor who has done illegal activities.
5. There are no same perceptions for saving government regulator to fuel subsidy.

Illegal activities for petroleum, gasoline and diesel fuel distribution describes in Figure 1 and 2.

Figure 1 Illegal Activities for Petroleum Distribution [7]

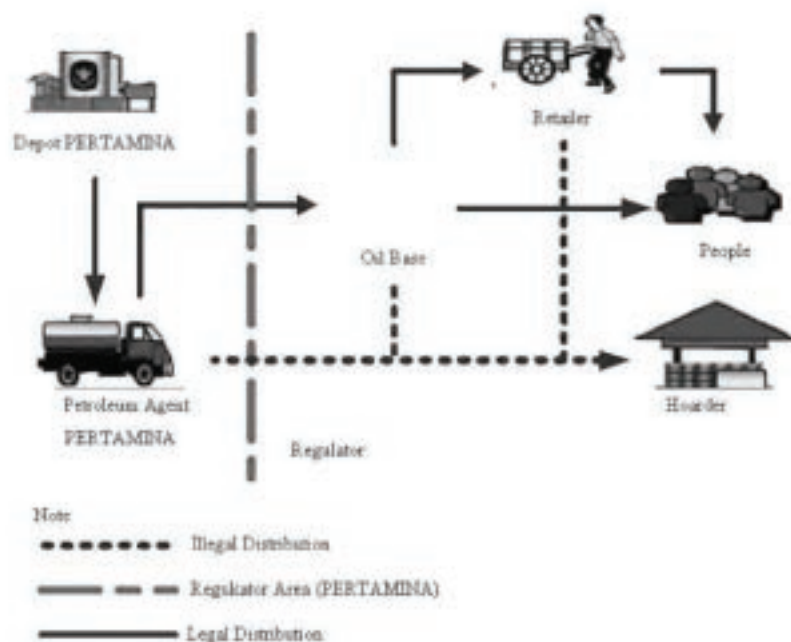
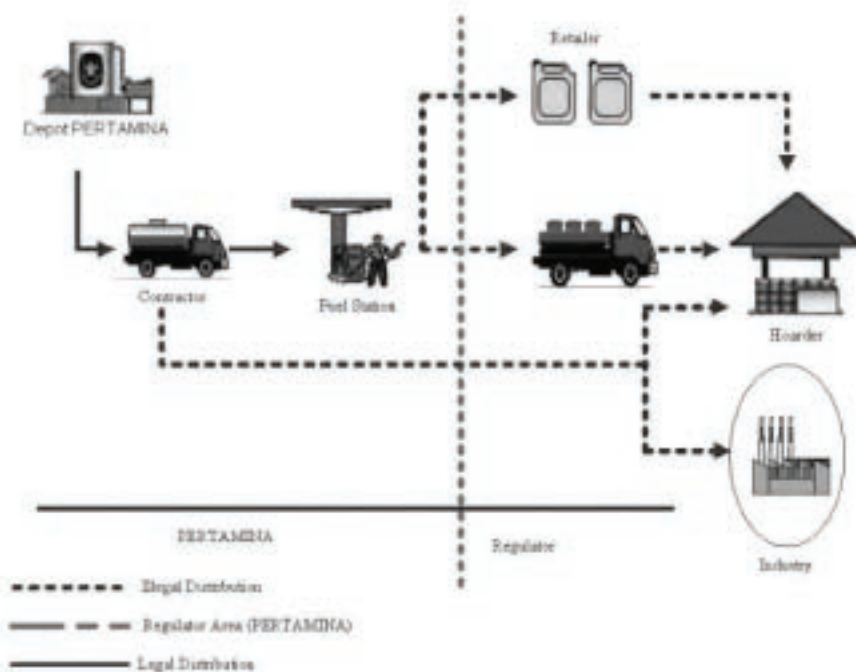


Figure 2 Illegal Activities for Gasoline and Diesel Fuel [7]



The impact of illegal fuel distribution i.e. [7]:

1. The deviation of subsidy fuel will cause fuel rarely in society
2. Fuel subsidy is not same with the objective to the poor people; it caused the economy to drop.
3. Disturbance of stabilization economy appears in society.
4. Disturbance of production activities because all machine are damage due using illegal fuel.

3. Revise Program

In practice, the regulator that regulates the consumption of fuel was not functioning property because there are so many illegal activities. One of the reasons is because there is no enforcement law. To overcome the problem, then, it needs law enforcement that is powerful for pressuring and supporting the regulator function, in one side, and for mobilizing the people to become consumer who will consumed by government in their fuel needed. In detail, the fuel distribution problems described as follow.

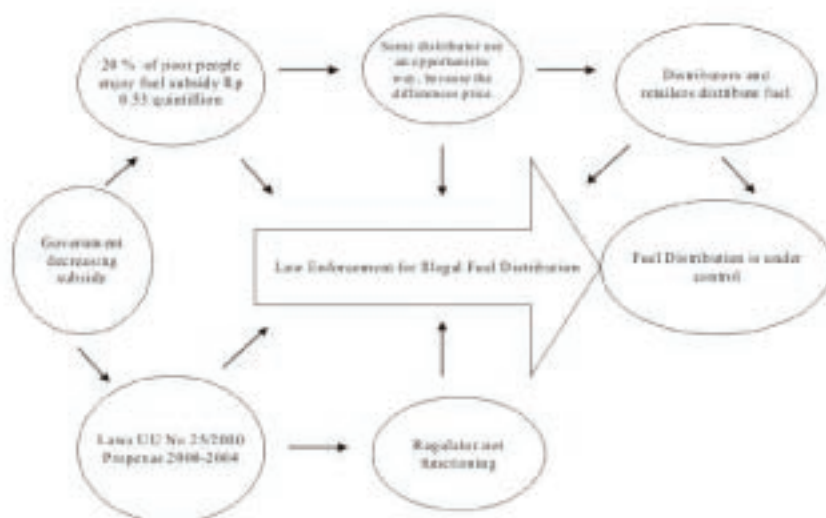


Figure 3. Background of Illegal Fuel Distribution Law Enforcement

In order to enforce law, it needs a collective action from regulator. The conceptual and operational frame of law enforcement described in Figure 4 and 5.



Figure 4 The Conceptual Frame of Law Enforcement

Figure 5 Operational Frame of Law Enforcement in decreasing fuel subsidy



4. Model Simulation

In this paper, we use distribution model, which based on the rule and procedure that obtained in Pertamina. For building a distribution model, the principal goal is to get a stable distribution flow (not disturb). It means that the producer could complete consumer demand. These goal was purposed in order to saw that disturbance in this distribution strip is not being caused by distribution process that had been done, but it caused by illegal activities (smuggling). There are six spots, which involved in this distribution, i.e.:

1. Depot Pertamina: as a distributor for petroleum, gasoline and premium.
2. Industry: as a diesel fuel consumer
3. Fuel Station: as a diesel fuel and premium distributor for people
4. Agent: as a petroleum distributor to oil base
5. Oil Base: as a petroleum distributor to retailer
6. Retailer: as a petroleum distributor to people
7. People: consumer that using petroleum, premium and diesel fuel

For each involved spot are represented by one actor, except in people spot. This actor has behavior to do dishonest and for doing interaction. For applying law enforcement program, in this model is using regulator actor, which act to control and to punish an opportunist actor. Beside that, Pertamina has role to give the direction for his consumer. In this model, we add an actor who has function to give a direction. This actor has care ness to do direction. All action from agent was influenced by environment. In this model is represented by four levels of regulator that is regulator level of Pertamina, regulator level of government and regulator level of LSM. Finally, the parameter in this model is subsidy level. It based on the fact that subsidy level highly influence to someone for doing dishonest.

5. Simulation

This simulation will use 2 scenario, i.e., scenario applying law enforcement, and not applying law enforcement. The parameter of subsidy used is 70%, it will be seen the effect from highly subsidy level to dishonest action. This scenario will be used for the Pertamina's products, i.e., petroleum, premium and diesel fuel.

5.1 Petroleum

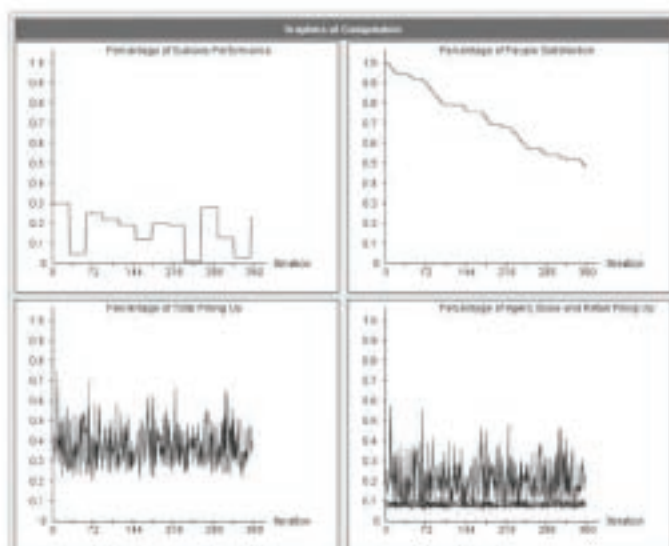


Figure 6. Simulation result for Petroleum without authority

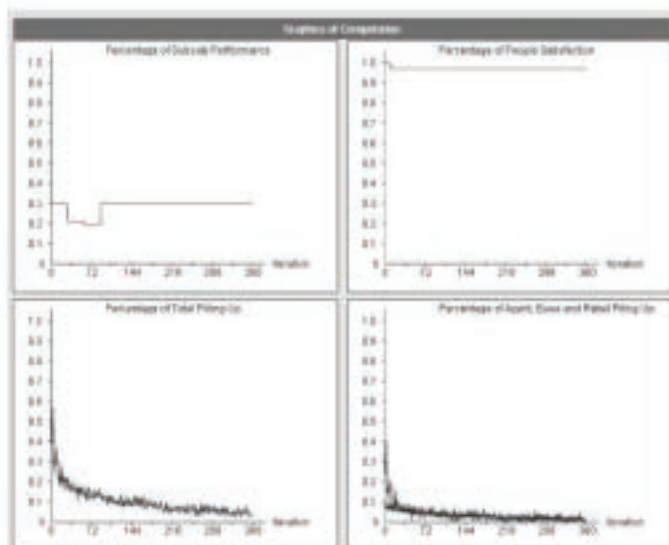


Figure 7. Simulation result for Petroleum with authority

In Figures 6 and 7, it can be seen that with authority, illegal activities decreased. The percentage of deviation is very big that is caused by long distribution trip. With this authority, the supports from government to people run well.

5.2 Premium

Figure 8. Simulation result for Premium without authority

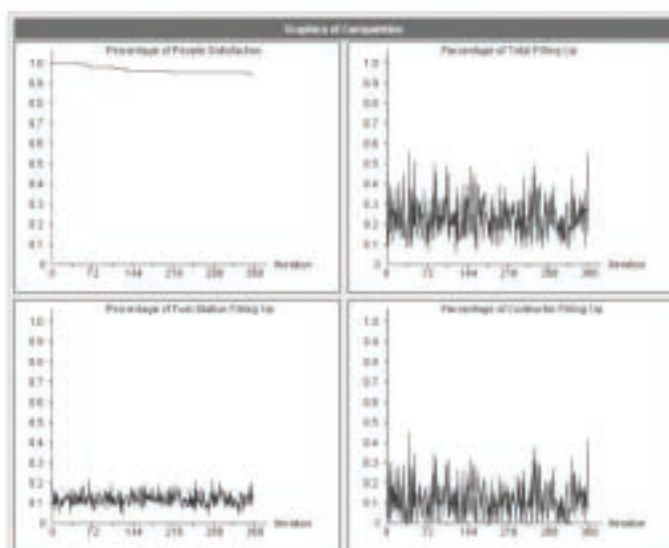
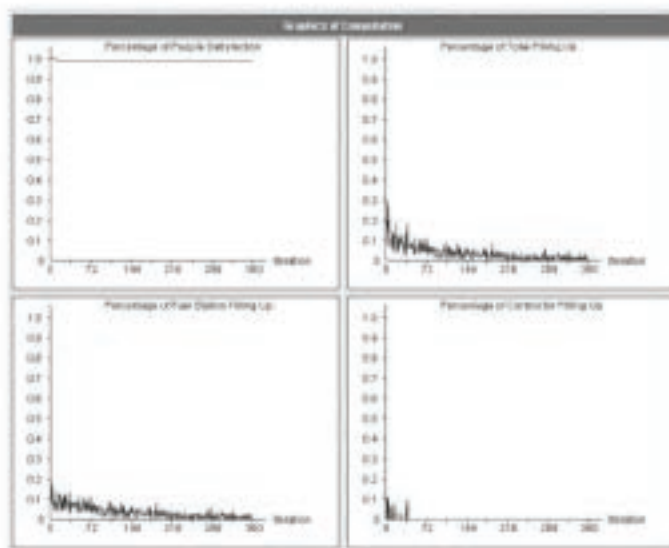


Figure 9. Simulation result for Premium with authority



In Figure 8 and 9, it can be seen that with authority, the illegal action decreased. If there is no authority and law enforcement, the contractors had done illegal action, while they should deliver supply to fuel station

5.3. Diesel fuel

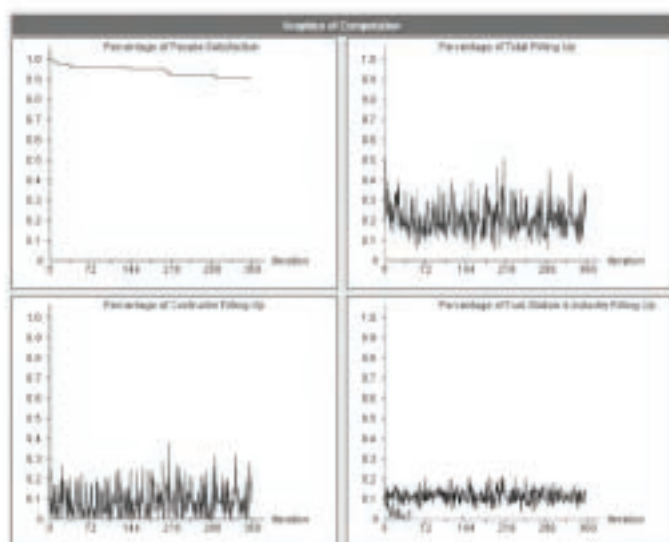


Figure 10. Simulation result for Diesel Fuel without authority

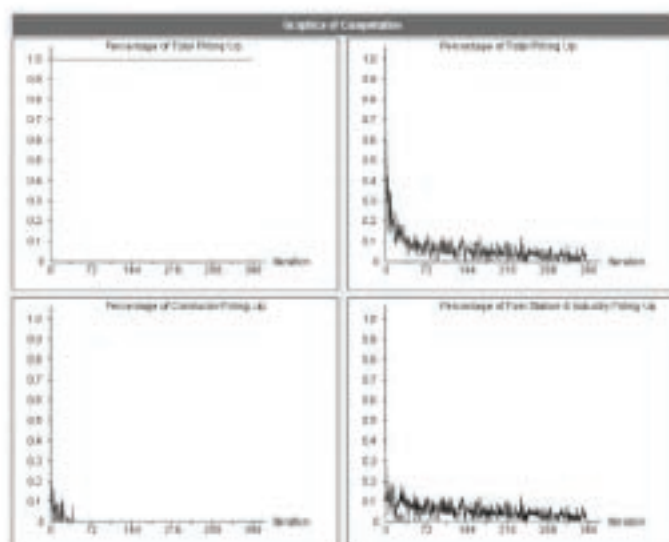


Figure 11. Simulation result for Diesel Fuel with authority

In Figures 10 and 11, it can be seen that with authority, the illegal action decrease. This result shows that contractor had done illegal action frequently if there is no authority and law enforcement.

6. Conclusion

The existence of authority for distribution system is very useful to achieve for good system performance. The longer of distribution trip can give the opportunity to opportunist actor for doing dishonest action. The availability of regulators is a significant factor to enforce the law. The decreasing of subsidy from government can be proposed if the fuel distribution and cash program (BLT) authority to poor people can run well.

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