



Subsidy Policy Evolution to Chemical Fertilizers and Management Information System Processing in Taiwan

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I. Introduction

Fertilizers are necessary inputs to agricultural production. Particularly, chemical fertilizers have led an effective and fast food production system since the “green revolution” in the 1960s. In the past, because of the “fertilizer exchange grains” policy, farmers were forced to exchange the harvest at the lower price than the market for the fertilizers at the government window, Fertilizer Transportation and Sales of Food Agency. During that period, the government could get more public grains from the rice harvest. In 1973, that policy was terminated and changed into a subsidy policy of fertilizers.

The fertilizers’ supply market has shown a multiple face in terms of fertilizer manufacturers and the retailing system. There are more than 500 fertilizer companies, including importers to supply more than 5,000 categories of fertilizers. In 2004, around 60% of the domestic fertilizers’ market was supplied by Taiwan Fertilizer Company, while the market share further increased to more than 80% in 2008, and then was reduced to 70% in 2009. The retailing system of fertilizers can be two folds: (1) farmers’ associations, with a majority of 60% sales market share; (2) other private-owned commercial retailing outlets, with a minor of 40% sales market sales.

The current annual usage volume of chemical fertilizers is approximately 1.01 million metric tons, mainly including ammonium sulfate, calcium superphosphate, potassium chloride, carbamide, and other fertilizer compounds. Except that ammonium sulfate can be domestically manufactured by mixing imported liquid ammonia, while others are all imported. The volume of the major chemical fertilizers used by domestic farmers is various, such as 185,000 metric tons of ammonium sulfate, 78,000 metric tons of carbamide, 88,000 metric tons of calcium superphosphate, 29,000 metric tons of potassium chloride, and 630,000 metric tons of other chemical compounds.

The government started to promote “adjustment of fertilizer prices and stabilization of supply-demand project” on May 30, 2008, in order to reflect the international commodity cost for domestic fertilizer supply stability, to secure the sufficient supply to farmers used at farming, and to encourage farmers to rationalize the usage of chemical fertilizers, with a policy support of subsidy to chemical fertilizers’ price difference away from the market fluctuations.

Fertilizer sales in Taiwan have maintained a traditional bookkeeping papers as records over many years. According to the “adjustment of fertilizer prices and stabilization of supply-demand project”, Council of Agriculture (COA) started to subsidize the price increase of fertilizers because of the market differences since May 30, 2008. However, the restrictions on the past approach of fertilizer sales by retailers (local farmers’ associations or fertilizer shops), hand-written bookkeeping has been the major records of fertilizer sales as well as subsidy amounts to farmers. Because of the unavailability of technology information to keep fertilizer sales data, the government has not been able to manage the data regarding fertilizer purchases by farmers, which causes inability of integrating technology information of subsidy projects.

In the concurrent development of cloud services by COA, Agricultural Food Agency (AFA) started to design a fertilizer subsidy information system in 2012. AFA further accomplished works of information system development by trials under newly regulated rules and further promote the extensions of the new system during 2013 and 2014. By the end of 2014, all local farmers’ associations located in each township and every fertilizer retailing shops have joined the information system to keep sales data by technology information.

Starting January 1st 2015, farmers’ ID numbers are scanned upon purchasing fertilizers which are subsidized by the government. The fertilizer sales are officially moved into the new era of technology information while the past hand-written registration was already considered outdated.

II. Evolution of fertilizer policy in Taiwan

Fertilizers are necessary materials for agricultural production. While chemical fertilizers include the three major elements, nitrogen, phosphorus, and potassium, for quick growth of plants it is widely used by farmers. However, because the market price of agricultural products cannot immediately reflect the price increase of fertilizers, the income of farmers are thus influenced by the cost increase of fertilizers.

In the past years during 1946 and 1972, the government took care of farmers by the exchange fertilizers for rice program by integrative sales of fertilizer quota to farmers while the supply of fertilizers was insufficient during that time. This program secured farmers with sufficient fertilizers for their farming needs. This program was

terminated at the first harvest in 1973. Between 1973 and 2002, the government decided to do an integrative cash purchase of fertilizers and delivered them to farm households. After 2003, the domestic fertilizer market has been fully liberalized, while the government went out of the control in fertilizer sales.

However, the international oil price was getting sharply increased after the US-Iraq War since March 2003, which also caused prices of international commodity and sea freight ton increase. Therefore, the domestic price of chemical fertilizers was also affected. Taiwan Fertilizer Company increased the selling price of fertilizers six times on March 3 and 16, and November in 2003, March, April, and August in 2004. On September 2004, fertilizer prices, compared with the pre-liberalization period (January 2003), increased by as much as 59% for potassium chloride, 49% for carbamide, or 6% to 19% for fertilizer compounds. The average price increase was 21%. Given that chemical fertilizers account for differential ratios in various crops during the planning, generally 5~8%, so the price increase caused the production cost per hectare also to increase. For example, the fertilizer ratio in rice accounts for 6.5~7%, so the fertilizer price increases caused the production cost of rice to go up to NT\$1000 per hectare. Other examples such as oranges increased cost by NT\$2,800 per hectare, Ai-wen mango by NT\$1,100 per hectare, and vegetables like *brassica oleracea* by NT\$2,800 per hectare. COA started the following fertilizer compensation program since September 2004 in order to buffer the major price increase of fertilizer market prices to negatively affect farmers' income.

1. Shipping cost subsidy: COA subsidized fertilizer shipping at NT\$ 250 per metric ton, equal to a price reduction of \$10 per (40-kilogram) pack. The subsidy was raised to \$500 per metric ton, or \$20 per pack since October 2005.
2. Subsidy of carbamide price differences for agricultural use: COA coordinated with fertilizer manufacturers regarding the price of carbamide for a reduction to NT\$ 8,450 (from original price of NT\$9,550) since November 2004. The government subsidized a share of the price difference at NT\$550 per metric ton in order to keep an easy price of carbamide for farmers. Taiwan Fertilizer Company supported the governmental policy to take care of farmers by stabilizing the fertilizer price since September 2004. The stick price has been maintained for more than three years for a stable farming cost for farmers with chemical fertilizer use. However, because of the international oil price jumps since the later half of 2007, it was impossible to keep the fertilizer price unchanged under the situation of sharp price increase in all major commodity prices. The production cost for fertilizer manufacturers was also sharply increased, given a 127% markup in carbamide price compared with September 2004 (from US\$278 per metric tons to US\$630), a 429% markup of phosphorite price (from US\$85 to US\$450), a 285%

markup of potassium chloride price (from US\$195 to US\$750).

3. Reduce fertilizer import tariff: In order to stabilize the supply and demand of domestic fertilizers, the government not only subsidizes price differences, but also reduced carbamide import tariff for one year by one point from 2% to 1%) with other 10 chemical fertilizers on October 4, 2004. Furthermore, the tariff of those 11 fertilizers became zero since June 21, 2006.
4. No sales tax for imported fertilizers: The amended Value-added and Non-value-added Business Tax Act on March 1, 2008 announced the free sales tax of fertilizers. In other words, if the fertilizers imported were as the same as in 2007 amounting to NT\$2.63 billion, the free sales tax would be reduced to NT\$0.132 billion cost of imported fertilizers. As the price of international fertilizers increased, given that the Taiwan Fertilizer Company's price remained unchanged, other fertilizer suppliers could not suffer the lost. Thus, the exit or reduced volume of fertilizer supply caused excess demand of domestic fertilizers because Taiwan Fertilizer Company could supply about 80% of the domestic demand. Therefore, COA implemented additional subsidy in the first half year of 2008 in order to fully supply the spring-season demand of fertilizers. The additional subsidy was to stick the fertilizer prices at the level in September 2004 and December 2007 by subsidy of fertilizer sellers in order to motivate fertilizer importers to maintain the volume. In the meantime, the buying price for farmers was also kept the same. However, the international commodity price increased much more than expected in the first half year of 2008. In the second quarter, the price of fertilizers could not afford the cost with the existing subsidy calculated by the price in December of 2007. The problem needed a resolution. COA announced "Fertilizer Price Adjustment and Stabilization Procedure" in May 30, 2008, aiming at stabilizing the domestic demand and supply of fertilizers reflect the cost determined by the international commodity market. The price of domestic chemical fertilizers was adjusted but given the retail price was still subsidized by the government, so that farmers can afford to purchase fertilizers.

Although the government's purpose was to take care of farmers, there have been issues raised since the fertilizer subsidy implementation. First, farmers did not feel any difference in the government subsidy because their purchase of fertilizer has been the after-subsidy price. Second, there was no limit amount for farmers to purchase the fertilizers with subsidy. Thus, crops could be fertilized using more amounts of fertilizers and having more subsidy. Third, because there was no identification of purchasers, it could not be sure that fertilizers were entirely used for farming. Fourth, the purchase record of fertilizers was not kept in any

information computer system, so the purchase information could not be well-managed and tracked. Fifth, the fertilizer market price difference was subsidized by the government, or charged by all tax payers, so the resource distortion problem was not fair. Finally, the government started to subsidize fertilizers since June 2008, with an accumulated amount of NT\$23.04 trillion by the end of 2014, which has been a very considerable amount of agricultural subsidy, ranging from NT\$2.5 trillion to NT\$5.75 trillion each year. The chemical usage amounts have not been reflected by the international commodity price, in the case that farmers have not adjusted the amount of fertilizer usage, with an annual amount of 1 million metric tons. The price difference of fertilizer manufacturers has been fully absorbed by the government subsidy in order to keep the final fertilizer retail price stable for farmers. Thus, the intensity of government subsidy to fertilizers has been highly dependent on the international commodity price.

As a consequence, COA plans the IC-card based management of fertilizer subsidy in 2015. First, COA will issue “farmer cards” with an IC chip to identify farmers. The card can be used for multiple purposes regarding all future agricultural policies and information management, such as subsidy to agricultural mechanic petrol and farming fertilizers at the beginning. Then, the IC card can also be used to manage the government purchase of public grains, fallow, crop transfers, contract farming, subsidy to agricultural facilities, and natural disaster relief aids. Second, the IC card for keeping farming record can be a tool for the government to understand the effective farmers, farming sizes and crops, so the subsidy can be rationalized with a limited amount per unit of farming activities. In addition, the government can effectively and timely monitor the flow and usage of fertilizers from the purchase record to the final outcome. Third, the fertilizer subsidy can be transformed into a cash subsidy after farmers purchase the market-priced fertilizers with the IC card. By doing so, farmers will get a feel of how much the government subsidizes.

III. Preparation of technology information system for fertilizer subsidy

The preparation of technology information system for fertilizer subsidy intends to ensure a retailing system with traceable sources and flows to record the sales and purchase of fertilizers. The preparation of the system establishment includes the development of information management system, operational procedures, and the promotion of extension and counseling to introduce the new system. The major preparations are summarized as follows:

1. Project team organization: Call a project team to promote and implement the new

system by a total of eight times in project meetings in order to plan the system architecture, operation guidelines, incentives, and project datelines of the major milestones. All front-line implementation units are invited to fully participate in order to achieve a broad-view of consensus.

2. Information system establishment and tests: The system of “farmer fertilizer purchase information and management system (in brief, The System, thereafter)” has been done since March, 2014. Then a number of six farmers’ associations were selected to implement a trial run to use farmers’ IDs as registration and record their purchases of fertilizers in the computer system. The System was proved well through the pilot test.
3. Operational guideline revision and modification: There were three rules formulated during August and November of 2014 for guidelines of the implementation of The System, including “Incentives for information technology system in fertilizer sales and subsidy”, “Farmer’s identification number for fertilizer purchase with government subsidy”, and “ Notes on fertilizer retailers in sales and orders of subsidized chemical fertilizers. In addition, a number of sixteen sessions of briefing was conducted in December 2014 under the guideline of “Price difference subsidy to the end price of chemical fertilizers” by telling all operational details to frontline agents in the new System.
4. Assistance to information technology establishment in all fertilizer retail outlets: Conduct 61 training courses for retailing sales personnel and trained a total of 1,623 people. In addition, incentives for retailers to establish information technology system for fertilizer sales (including the purchase of computers, printers, bar coders, internet connections, and System operation) are provided to a total of 1,650 retailers by the end of 2014.
5. New System for promotion: A plan of 265 farmer briefings will be conducted nationwide at township and city levels. In addition, 3,500 copies of posters are distributed with additional media exposures through local radio broadcasts, public electronic billboards, and other channels in order to inform the farmers.

IV. Full efforts on promoting information technology for chemical fertilizer

The government started to make a full effort in promoting information technology system for recording sales and purchase of chemical fertilizers since January 1st, 2015, in order to raise the service efficiency for farmers and the implementation effectiveness in the agricultural sector. Farmers have to register their ID numbers to purchase subsidized fertilizers, which replaced the conventional hand-written process of implementation (Figure 1 and Figure 2).

The new System can achieve several benefits because all information regarding

the supply, retail/ store, and purchase of fertilizer is registered, recorded, and followed in the information system. The application of modern technology is able to control and manage timely and accurate information to provide a fast and correct subsidy service to farmers. The major benefits are listed below.

1. Technology information replaces paper work: It is easier for farmers to purchase the subsidized fertilizer and in the meantime, it can save a considerable time to have long-waiting line for hand-written process. Thus, the manpower of recording can be cut down, which saves another cost.
2. Enhance government resources and service effectiveness: Information technology can enhance the flow information of fertilizers for subsidy, which can prevent misuses and utilize public resources. Moreover, it can accelerate subsidy operation flow and cash issue of subsidy via an integrative information system.

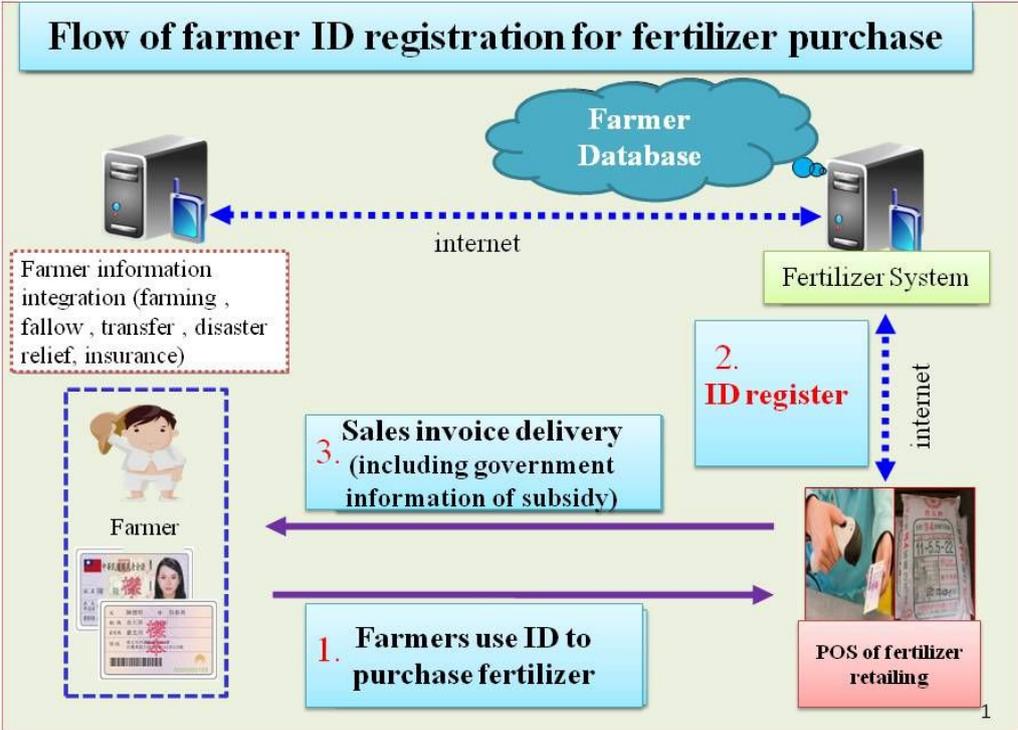


Figure 1: Flow chart of chemical fertilizer subsidy and purchase in the new system

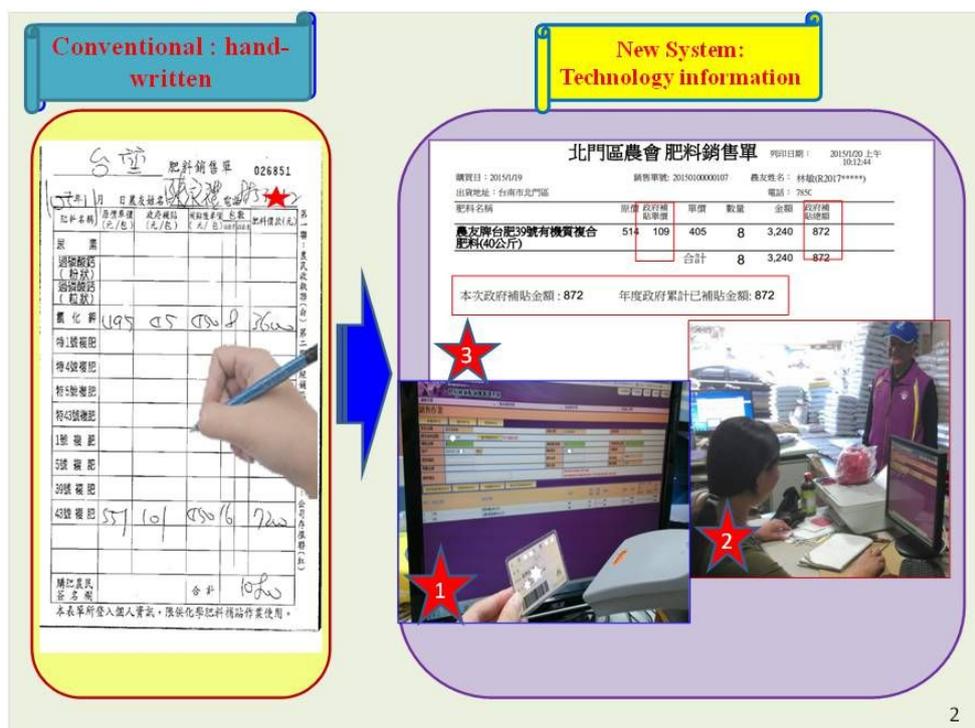


Figure 2: Comparison between conventional hand-written document and computer system of information processing

V. Summary

COA plans to combine farmers' ID and subsidy operations in a new information technology system in order to enhance government service quality and efficiency to farmers. The policy effectiveness and farmer application process can thus be improved.

The new System of fertilizer subsidy can save time for farmers to purchase fertilizers because retailers do not need to issue hand-written invoices anymore. In addition, the government can manage complete information by the integration and control of subsidy operation. It is a scenario of triple wins among farmers, retailers, and the government.

In the future, the cloud service of agriculture will gradually include all kinds of agricultural information and hopefully enhance the service quality and policy efficiency of the government.

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