

MARKET STRUCTURE OF THE CORN SEED INDUSTRY IN EAST JAVA

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ABSTRAK

Makalah ini menelaah tentang struktur pasar industri benih jagung di Jawa Timur. Struktur pasar di tingkat produsen sangat oligopolistik yang mana volume penjualan didominasi oleh produk beberapa perusahaan multinasional berupa benih jagung hibrida. Pengemasan dan jenis varietas merupakan indikator utama diferensiasi produk. Semua produsen memperoleh informasi pasar secara memadai. Investasi yang cukup tinggi merupakan penghalang utama untuk masuk dan pangsa pasar yang sudah mapan merupakan faktor utama untuk meninggalkan industri ini. CR₄ di tingkat pedagang menunjukkan bahwa pedagang besar-pengecer bersifat oligopolistik, tetapi pengecer relatif bersaing. Mendorong investor baru untuk masuk ke dalam industri benih merupakan pilihan kebijakan pemerintah yang bisa mengurangi konsentrasi produsen yang relatif tinggi dalam industri ini.

Kata kunci : *struktur pasar, pangsa pasar, oligopoli, Jawa Timur*

ABSTRACT

This study attempted to describe market structure of the corn seed industry in East Java. Market structure of the industry at the producer level was highly oligopolistic characterized by dominant volume of sales of few multinationals through their hybrid corn seed products. Packaging and types of varieties were the main indicators of product differentiation. All producers were well informed about the market. High capital investment was the main barrier to entry and established market share was the most important barrier to exit. CR₄ at the traders' level showed that the wholesaler-retailers were oligopolistic, but the retailers were relatively competitive. Encouraging new investors to entry into the corn seed industry is the policy the government can take to reduce high concentration in this industry.

Key words : *market structure, market share, oligopoly, East Java*

INTRODUCTION

Background

The Government of Indonesia initiated an integrated seed production project during the first Five-Year Development Plan, i.e., 1969-1974. This project started with a campaign to boost the production and distribution of quality seeds of high-yielding varieties (HYV). The main activities of the campaign were as

follows: (1) rehabilitation and expansion of seed farms; (2) establishment of the National Seed Company (NSC), i.e., PT Sang Hyang Seri, to produce and distribute quality seeds; (3) establishment of the Seed Control and Certification Service (SCCS); (4) strengthening of the Food Crop Research Institute to produce quality breeder seeds and as a source of seed technology; (5) founding of the National Seed Board; and (6) planning and implementation of seed regulations. During the first two Five-year Development Plans (1969-1974 and 1974-1979), the Indonesian government prioritized production and distribution of rice seeds to maintain rice production as the staple food. Since the third Five-Year Development Plan (1979-1984), the government also paid attention to soybean and corn seed production due to increasing demand for livestock feeds (Soemartono, 1987). These government policies and programs encouraged the development of the domestic seed industry through the establishment of domestic and foreign private seed companies.

Market opportunities, especially for hybrid corn varieties, are still promising considering that there is a wide gap between corn seed production and demand. For example, hybrid corn seed used by Indonesian farmers in 1996 was only 12.4 percent of the total corn seed requirement (Sulaiman *et al.*, 1998). In 2000, it was only about 15 percent of the total area planted to corn used hybrid corn varieties, unlike in the Philippines with 40 percent and in Thailand with 86 percent (CPAS, 2001). In 2004, the total area planted to hybrid corn varieties was 21 percent, but in the same year the total areas planted to hybrid corn varieties in Vietnam, Philippines, and Thailand were 35, 60, and 95 percent, respectively (Mulya, 2004).

Information on the market structure would be very useful in identifying the weaknesses of the corn seed industry in Indonesia. The problems of the industry can then be addressed by policy makers through setting of appropriate policies that would promote the Indonesia's corn seed industry.

Objectives

The major objective of this study was to analyze the market structure of the corn seed industry in East Java Province, Indonesia. Specifically, the objectives of the study were to assess (i) the degree of concentration of the seed producers and traders, (ii) product differentiation, (iii) market knowledge, and (iv) barriers to entry and exit.

THEORETICAL FRAMEWORK

Market structure is defined in terms of the organization of a market which seems to influence strategically the nature of competition and pricing within the market (Bain, 1968). Market structure of the corn seed industry has

some main elements, namely: (1) degree of buyer and seller concentration; (2) degree of product differentiation; (3) barriers to entry and exit; and (4) market knowledge. Market structure determines the behavior of a firm in the industry while market behavior, in turn, affects the industry's performance.

The degree of concentration refers to the ownership or control of a large proportion of some aggregate of economic resources or activity either by small proportion of the units which own or control the aggregate, or by small absolute number of such units. In this study, the interest is in the concentration of the control of the volume of corn seed production and sales at the seed companies'/producers' (both government-owned and private) level and in the concentration of the control of the volume of corn seed sales at the seed distributors' level.

Market share and profit rate is positively correlated such as shown in Figure 1. A firm with its market share less than 10 percent is said to have no market power. Market power emerges if it reaches 15 percent, and it gives a significant degree of monopoly when it is 25 to 30 percent (Sheperd, 1997). At market shares more than 40 to 50 percent, the market power is relatively strong. If the *b* slope is high, then market share is worthwhile and will be hunted for rigorously. Over time, market power of a firm may vary mainly with its market share. Concentration implies the degree of market power (Suvanichwong, 1997). Market power is ability of a firm to influence perceptibly the price and quantity in the market. It is also the firm's share of the industry's total sales revenue and it may vary from 0 to 100 percent.

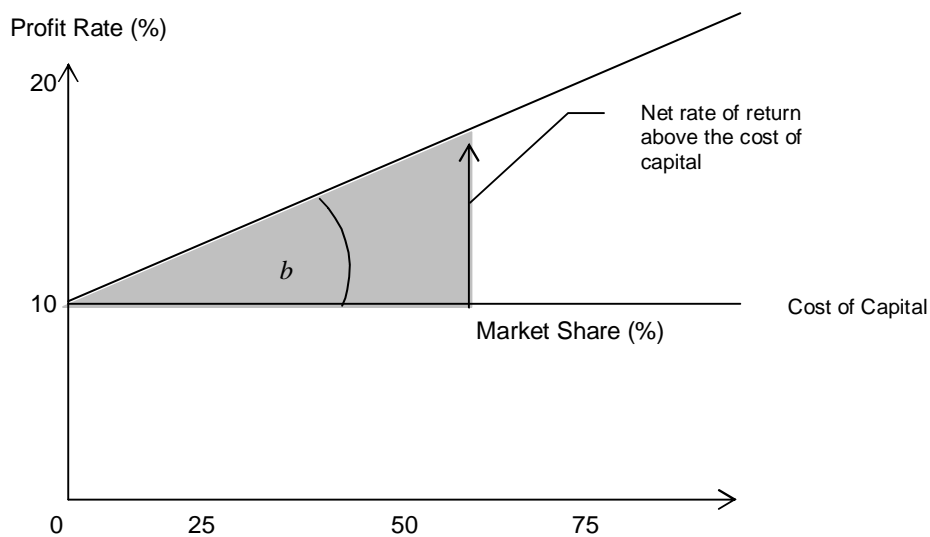


Figure 1. Basic Relationship between Market Share and Profitability (Adopted from Sheperd, 1997)

Market entry is the addition of one or more new sellers to a market. Net entry is relevant to take into account because it reflects the difference between shares of entrants and the shares of firms that exited during a period. The speed of entry could occur very fast or very slowly. On the other hand, barriers against entry are situations that make entry difficult. There are two sources of barriers, i.e., exogenous and endogenous sources. Exogenous resources are found in the underlying market, such as capital requirements, economies of scale, absolute cost advantage, product differentiation, sunk costs, vertical integration, and formal, official barriers set by government agencies or industry-wide groups. Endogenous sources are conditions and strategies implemented by the dominant firms and may be voluntarily done, which consist of retaliation and preemptive actions, excess capacity, marketing expenses, market segmentation, legal barriers such as patents, controls over strategic resources, and secrecy (Sheperd, 1997).

The degree of product differentiation would determine if the buyers differentiate, distinguish, or have specific preferences among the competing outputs of the various sellers established in an industry (Suvanichwong, 1997). In the corn seed industry, corn seeds can be differentiated in terms of varying characteristics of different corn varieties, brands, and packaging. Product differentiation as a barrier can be observed in advertising and other seller activities which aim at intensifying the difference between a firm's product and the products of the competitors.

On the other hand, absolute cost advantage of established firms is the ability of established firms to produce the products at a lower cost than the new firms because of skills of expert management personnel, control of the supply of raw materials, lower price of raw materials due to exclusive arrangement with suppliers or bulk-buying of the established firms, lower cost of capital, vertical integration or the production power of the established firms, patents, and superior technique available only to the established firms.

RESEARCH METHODOLOGY

Data Collection

Primary data were gathered from the corn seed companies and corn seed distributors through personal interview using pre-tested questionnaires. Data gathered from the seed companies included the following information: year established, number of employees, capital investment, volume of corn seed production by variety, technology used in corn seed production, area planted to corn for seed production purposes, volume of corn seeds produced by variety and by season, production practices, and brand names of seeds sold. Secondary data were gathered from the related institutions.

Sampling Procedure

East Java Province was purposively selected as the study area because it is a major corn-growing area in Indonesia and has the biggest number of seed growers/companies and the second biggest distributors in the country. Complete enumeration was employed in the survey of corn seed companies and distributors in East Java. The study was focused in the regencies of Jombang, Kediri, and Nganjuk. The study was conducted in 2002 and covered 3 multinationals, 5 local companies (i.e., 1 government-owned and 4 privates), 32 wholesaler-retailers (Jombang 7, Kediri 14, and Nganjuk 11), and 75 retailers (Jombang 14, Kediri 33, and Nganjuk 28).

The corn seed producers chosen as samples of the study were Global-1 (Kediri and Sidoarjo regencies), Global-2 (Surabaya municipality and Malang regency), Global-3 (Surabaya), Local-1 (Pasuruan and Malang regencies), Local-2 (Kediri regency), Local-3 (Malang regency), Local-4 (Jombang regency), and Local-5 (West-Sumatera based, its distributor in East Java).

Market Structure Analysis

The dimensions of market structure of the corn seed industry in three major corn-producing regencies in East Java, which were evaluated in this study, were degree of buyer and seller concentration, product differentiation, barriers to entry and exit, and market knowledge.

Degree of Concentration

The number and distribution of seed companies/growers by type (i.e., local vs. foreign companies; government vs. private companies) and traders/distributors by type (i.e., wholesalers or retailers) were described. The degree of buyer and seller concentration at the traders' level was assessed using concentration ratio of the biggest-four firms (CR_4), Hirschman-Herfindahl Index, Entropy Index, and the Gini Ratio. At the corn seed producers' level, the seller concentration ratio and the Gini Ratio based on the volume of sales of local corn seed producers and multinational seed companies were computed.

Concentration Ratio (CR). This method is the most frequently used measure of concentration in an industry due to its simplicity. It is an easily understandable index of concentration. However, CR does not take into account different sizes in the largest firms and it just compares several large firms as a group with the rest of the firms in the industry. CR is formulated as

$$CR_m = \sum_{i=1}^m P_i$$

where:

CR_m = concentration ratio of the m top seed producers or traders in the industry

P_i = total market shares of those m largest seed producers or traders expressed in percent. This was computed by dividing the total volume of corn seed sales of the biggest four producers or traders (seed distributors) by the total volume of seed sales of all producers/traders in the industry.

This study mainly computed CR_4 , i.e., concentration ratio of the biggest-four seed producers and traders. The market is considered to be a highly concentrated one if the four-firm ratio (CR_4) is at least 40 percent (Parker and Connor, 1979).

Hirschman-Herfindahl Index (HHI). This index was computed by getting the sum of the square of the market shares of all traders in the market. It is expressed as follows:

$$HHI = \sum_i^n P_i^2 = \frac{1 + (cv)^2}{n}$$

where:

HHI = Hirschman-Herfindahl Index

n = total number of firms in the industry

cv = the coefficient of variation of firm size

P_i was defined previously.

The value of HHI ranges from 0 to 1 with larger values indicating greater concentration. When all firms are of equal size, HHI is equal to $1/n$. When $H = 0$, it means that there are infinity firms in the industry or it is a competitive market. When $HHI = 1$, it is a monopolistic market. The value between 0 and 1 indicates an oligopsonistic market structure. This index is sensitive to the shares of the largest firms. It reflects the share of each firm in the industry. An advantage of HHI is that it can be used to measure changes in the market share because it takes into account all firms in the market.

Entropy Index (EI). The definition of this index is inversely related with those of the two other indices. High concentration in the industry is indicated by the low value of the index. EI was calculated as follows:

$$E = \sum_i^n P_i \log \left(\frac{1}{P_i} \right)$$

where:

EI = Entropy Index

P_i was defined previously.

This index is the most sensitive to firm numbers than any other indices. The strength of EI over HHI is that EI could be decomposed into within and between group components. It is useful when the industry consists of sub-industries.

Gini Coefficient (Gr). The Gini coefficient measures the departure of the Lorenz curve actually observed and the curve which would appear if all firms have equal market shares. When the Gini coefficient is zero, this implies that there is perfect equality of the firms' market share. This is a characteristic of a purely competitive market. A value lower than 0.5 and close to zero would indicate high equality in corn seed production or sales distribution share or vice versa. The Gini coefficient was computed as follows:

$$Gr = \frac{[(\sum X_i Y_{i+1}) - (\sum X_{i+1} Y_i)]}{10,000}$$

where:

Gr = Gini coefficient in percent

X_i = cumulative percentage of market share in a given quintile group

Y_i = cumulative percentage of firms in a quintile group

Both X_i and Y_i was arranged from the highest to the smallest.

Product Differentiation

At the seed growers'/seed companies' level, product differentiation was assessed in terms of variety and genetic technology used (e.g., hybrid or genetically modified organism, GMO). The study also solicited the corn farmers' opinion on the seeds that they purchased in terms of quality (i.e., germination rate and seed characteristics). Product differentiation was also determined based on brand names and varieties of corn seeds sold by the distributors.

Market Knowledge

The seed companies' and distributors' market knowledge was assessed. Market information included the types and varieties of corn seeds preferred by corn companies/farmers, potential seed requirement by region, and the prevailing market price. Their sources of market information were also identified in this study and the frequency of accessing market information was determined.

Barriers to Entry and Exit

Barriers to entry and exit at the seed companies and the distributors'/traders' level were examined in this study. Barriers to entry in the corn seed

industry covered the following aspects: (1) economies of scale; (2) capital requirement; and (3) legal barriers such as license and patents.

Economies of scale was assessed by examining the cost structure of large and small-scale firms. The average cost of large firms (large seed traders) was compared with that of small firms (small seed traders) in order to determine whether or not economies of scale exists in the corn seed industry. The advantage of established seed firms over new entrants that supported economies of scale was evaluated in terms of technological innovation. and Capital requirement at the seed companies' and distributors' level was examined according to the scale of operation and compared to the average investment of the industry.

RESULTS AND DISCUSSION

Profiles of the Producers and the Traders

Global-1, Global-2, and Global-3 are multinational companies in which among their products are hybrid corn seeds. Those companies operate in the country through their subsidiaries. Domestic1-1 to Domestic-5 are local companies specialized in producing food-crops seeds including corn seed. Local-5 produces hybrid corn seed invented by its own company, while the other four local companies produce corn seed invented by the AARD and/or University.

Most of corn seed businesses were established in the 1990's. Some corn seed traders initially sold agricultural inputs before they began selling commercial corn seeds. Before the 1980's, most of the commercial corn seeds were produced and sold by Domestic-1 and other local producers. In the 1980's, when the hybrid corn seed was introduced, the market for commercial corn seeds became attractive. The hybrid corn seed companies like Global-2 and Global-3 produced and sold their own products, while Domestic-1 promoted the hybrid seed of Cargill and AARD.

Corn seed traders in the province of East Java were characterized by small business with no retailer specializing in selling corn seeds. Only 15 percent of the corn seed retailers registered with the SCCS East Java and the rest were unregistered compared to twenty (63%) registered wholesaler-retailers.

Foreign investors, on their own, were not involved in commercial corn seed distribution and retail. Only the domestic traders and seed producers perform the marketing function of selling their products directly to the government projects or to local traders. Foreign firms enter into joint-venture agreements with domestic investors and established their own marketing companies by assigning one or two distributors in each regency. Besides

commercial corn seed, the traders also sold pesticides, chemical fertilizers, rice seeds, vegetable seeds and agricultural equipment, especially hand sprayers. This indicated that the main business of the corn seed traders was agricultural inputs.

Seed retailers employed, on the average, a minimum of one and maximum of five persons. Wholesaler-retailers, on the other hand, had more employees ranging from one to 24 persons. The traders with only one employee were usually family-run businesses, managed by either the wife or husband, while their spouses worked elsewhere.

Market Structure

Basically, the corn seeds sold in the market were classified into certified and uncertified seeds. The certified seed consisted of the hybrid and composite varieties. Uncertified seeds, also called illegal seeds, are sold without labels and brand names. The local term for the illegal corn seed is *putihan* which means white seed, reflecting its original color without the chemical treatment. Legally sold seeds usually bore a reddish color resulting from its treatment with the fungicide Ridomil. The illegal seeds included hybrid varieties like those produced by Global-1 and Global-2. Hybrid corn seed dominated the volume of sales at both wholesaler-retailers' and retailers' levels (Table 1). The illegal seeds made up 2 percent of the wholesalers-retailers' volume of sales representing 1.9 percent of the total value of sales. The low figure for the illegal seeds market could be a result of the traders' apprehension to reveal the truth despite the absence or lack of government monitoring. Transactions on illegal seeds were conducted privately between the trader and the consumer.

The volume of sales for the composite varieties consisting of Arjuna BISI, Surya, and Bisma accounted for 90.6 tons per year or 6.0 percent of the total volume of sales while the hybrid varieties' volume of sales at the wholesaler-retailers' level was more than 1,400 tons (92.0%).

At the retailer's level, 384 tons of hybrid corn seed was sold representing 95 percent of the total sales. The composite corn seed's volume of sales accounted for 90 tons (4%) while the illegal seeds sold as much as 5 tons (1%). The study found out that the Bisma variety, which was propagated by local producers, was found only at the wholesaler-retailers end and not at the retailers' level. This indicated that the Bisma corn variety was directly purchased by farmers from them and no retailers stocked it because of the low demand for the seed. Bisma's volume of sales of 24 tons, which is less than 2 percent of the total demand at the wholesaler-retailers' level, was lower than the demand for Arjuna BISI and Surya varieties. This also showed that the locally-produced corn variety faced a stiff competition in the market.

Table 1. Volumes and Values of Corn Seed Sales by Season in East Java, 2002

A. Wholesaler-Retailers						
Variety/ brand	Volume of Sales			Value of Sales		
	Peak Season (kg)	Off Season (kg)	Whole Year (kg)	Peak Season (Rp'000)	Off Season (Rp'000)	Whole Year (Rp'000)
Illegal Seed						
Bisi	750	20300	21050	6,000	202,400	208,400
Pioneer	0	10000	10000	0	160,000	160,000
Subtotal			31050			368,400
(%)			(2.04)			(1.23)
Composite						
Arjuna Bisi	16985	17365	34350	104,173.125	108,183.125	212,356.25
Surya	16125	15785	31910	99,353.125	96,078.125	195,431.25
Bisma	11080	13270	24350	56,995	66,469	123,464
Subtotal			90610			531,251.5
(%)			(5.95)			(1.77)
Hybrid						
Bisi	272415	136345	408760	5,125,145	2,395,727	7,520,872
Cargill	179090	102110	281200	34,36,712.5	1,941,400.75	5,378,113.25
Pioneer	395050	316390	711440	8,874,996.25	7,260,743.75	16,135,740
A-4	200	300	500	3,200	4,800	8,000
Subtotal			1401900			29,042,725.25
(%)			(92.01)			(97.00)
Total	891695 (58.53)	631865 (41.47)	1523560 (100.00)	17,706,575 (57.41)	12,235,801.75 (39.67)	29,942,376.75 (100.00)
B. Retailers						
Illegal Seed						
Bisi	3100	0	3100	24,800	0	24,800
Pioneer	2250	0	2250	18,000	0	18,000
Subtotal			5350			42,800
(%)			(1.32)			(0.53)
Composite						
Arjuna Bisi	8595	5290	13885	64,250	37,450	101,700
Surya	400	450	850	2,950	3,300	6,250
Subtotal			14735			107,950
(%)			(3.65)			(1.34)
Hybrid						
Bisi	81210	15205	96415	1,575,215	307,330	1,882,545
Cargill	91730	29190	120920	1,752,120	543,552.5	22,95,672.5
Pioneer	131597	35181	166778	2,872,193	851,498.5	3,723,691.5
Subtotal			384113			7,901,909
(%)			(95.03)			(98.13)
Total	318882 (78.89)	85316 (21.11)	404198 (100.00)	6,309,528 (78.35)	1,743,131 (21.65)	8,052,659 (100.00)

Note: The existing exchange rate was U.S. \$ 1 to Rp 9,000

Degree of Buyer and Seller Concentration

Cumulative ratio of volumes of sales for the producers was measured using CR₄. The degree of buyer and seller concentration for the traders was estimated using CR₄, Hirschman-Herfindahl Index, Entropy Index, and Gini Coefficient.

In 2001, the corn seed market in Indonesia was dominated by Global-1 and Global-2 with sales volumes of 4,000 tons (49.8%) and 3,000 tons (37.3%), respectively. Thus, both multinational producers acquired 87 percent of the national corn seed market share. Global-3 and Local-1 each had market shares of 6.2 and 4.2 percent, respectively (Table 2). Concentration Ratio of the four largest firms revealed an oligopolistic corn seed market in the country (CR₄ = 98%).

Table 2. Cumulative Ratio of Volume of Sales of Corn Seed Producers at the National Level, 2001

Seed Producer	Volume of Sales (tons)	Percentage (%)	Cumulative Ratio (%)
Global-1	4000	49.8	49.8
Global-2	3000	37.3	87.1
Global-3	500	6.2	93.3
Domestic-1	340	4.2	97.6
Domestic-4	90	1.1	98.7
Domestic-2	40	0.5	99.2
Domestic-3	40	0.5	99.7
Domestic-5	25	0.3	100.0
Total	8035	100.0	

In 2001, Global-2 held 52.7 percent (1,160 tons) of the market in East Java while Global-1 followed with 34.1 percent (750 tons). Global-3 and Domestic-1 with respective markets shares of 9.1 and 1.7 percent (Table 3), ranked third and fourth, respectively. CR₄ of the producers in this province was 97.5 percent which showed that the corn seed market was highly oligopolistic. Estimated demand for corn seed all over the country in 2001 was 4,962 tons and in East Java province in the same year was 4,203 tons (Ditjen Tanaman Pangan, 2002).

All corn seed producers tried to get as much market share as possible in East Java because this province was the largest corn producing area in the country. The overall production of these producers could only supply some of the demand for corn seeds in East Java. The hybrid corn seeds produced by

both multinational and local producers could satisfy only 43 percent of the demand. The remaining demand was filled in by the illegal seeds and second generation (F2) seeds. On the other hand, the composite corn seed sold by these producers satisfied only 2 percent of potential demand. Most farmers used corn seeds produced from their own farms because the composite corn seeds still produced good yields up to several generations.

Table 3. Cumulative Ratio of Volume of Sales of Corn Seed Producer in East Java, 2001

Seed Producer	Volume of Sales (tons)	Percentage (%)	Cumulative Ratio (%)
Global-2	1160	52.7	52.7
Global-1	750	34.1	86.7
Global-3	200	9.1	95.8
Domestic-1	37	1.7	97.5
Domestic-4	30	1.4	98.9
Domestic-2	12	0.5	99.4
Domestic-3	12	0.5	99.9
Domestic-5	1	0.0	100.0
Total	2202	100.0	

In East Java province, the market share of Global-2's hybrid corn seed in 2001 was 1,160 tons which shrank to 625 tons in 2002. Global-1's volume of sales also declined from 750 tons to 600 tons during the same period. However, Global-3 was able to expand its volume of sales from 200 tons to 400 tons (Table 4). In 2000, Global-3 started marketing its C-5 and C-7 seed products but the data on volume of sales cannot be precisely determined because most of the seed traders selling those corn seed, especially in the area of study, did not pay their credit to the producer.

Table 4. Volume of Corn Seed Sales of Multinational Companies in East Java, 2001-2002

Year	Market Share (tons)		
	Global-2	Global-1	Global-3
2001	1,160	750	200
2002*	625	600	400

Note: *) Up to June 2002

Up to June 2002, the corn seeds sold by Global-1 at national level reached 2,200 tons with a value of around Rp 33 billions (US \$ 3.67 millions). The volume of sales of Global-1 consisted of the hybrid corn seed varieties BISI-2 and BISI-5, which accounted for 60 percent. The CPI-2 hybrid accounted for 30 percent and the rest (10 %) was for the sales volume of composite the varieties Arjuna BISI and Surya. The sweet corn seed varieties, F1 BISI Sweet and Super Sweet, were sold with smaller volumes of sales.

Global-1's corn seed production area in 2001 was around 4,500 hectares. The farmlands were owned by the farmers who had contract agreements with Global-1. The area owned by Global-1 was less than 7 hectares and was used for research purpose located near the processing plant in Kediri regency, East Java.

Global-2 also had a similar sales pattern of 40 percent at national level while 30 percent of its sales in East Java was sold to government projects. Global-3 also sold some of its corn seed products to the government agencies. In 2001, Global-2 produced around 6,300 tons of corn seeds from its processing plants in Kabanjahe (North Sumatera) and Malang 2 (East Java). The plants have respective capacities of 7,000 and 3,000 tons per year. However, the processing plant at Malang 1, East Java province, was deactivated after since opening of the Malang 2 processing plant. This company had no farmland of its own to produce corn seeds. The parent seeds were imported from India and the Philippines, where its holding company operated research centers. The company claimed that it could satisfy around 55 percent of market demand. The actual market share, however, was only less than 50 percent.

The volume of sales of Global-2 in East Java tended to decline. Until June 2002, its volume of sales reached only 625 tons in the same province due to the tight competition from the new comer Global-3, and an established company Global-1. On the other hand, Global-2 had to export some of its unsold products. In 2001, the company exported 5,000 tons of corn seed to Japan, Thailand, Philippines, and Pakistan (Kompas, 2001).

Besides producing hybrid and composite corn seed, Global-1 also generated hybrid rice seed, vegetable seed, and fruit seed. Of the total sales value, corn seed accounts for 45 percent; vegetable and fruit seed, 40 percent and; the remaining 15 percent came from the sales of pesticides, fertilizers, and agricultural equipment. All of the seed produced by Global-1 were sold by its marketing company with the brand names of Cap Kapal Terbang (Aircraft Brand). Many corn seed varieties had been propagated, but only some of them are sold in the market.

In 1983, Global-1 started producing the hybrid corn variety, CPI-1, and in 1992, it released CPI-2. Later, the company produced other corn seed varieties, the BISI-1 and BISI-2 in 1995. In 2001, it produced the BISI-15 variety (Table 5). Among global-1's hybrid corn lines, the varieties most preferred by

consumers were BISI-2, BISI-5, and CPI-2. Two varieties of sweet corn seed, namely the F1 BISI Sweet and Super Sweet Corn, were also produced by this company. Most of sweet corn seed were sold in the temperate areas where those varieties are adapted. Composite corn seed varieties sold were Surya and Arjuna BISI. The Arjuna variety was propagated by Global-1 and released in 1996. It was a composite corn seed generated by the breeders at the AARD but was produced and sold by Global-1.

Global-2 had already released 19 hybrid corn varieties in Indonesia, but only 13 varieties marketed subject to consumers' acceptance. The first corn seed variety released by this company in 1985 was Pioneer-1 (P-1) and was followed by another variety in 1986, namely P-2. Both corn seed varieties were marketed by a domestic marketing company (PT GSMA). A new variety, i.e. P-3, was released in 1992 and the latest was P-19.

Global-3 produced hybrid corn seed with the brand name C. The company had released 10 varieties of hybrid corn seed, namely C-1 in 1983 until C-10 in 2001. Both C-1 and C-3 seed varieties were produced and marketed by Domestic-1. Starting in 2000, Global-3, through its marketing company (PT BS), distributed C-5 and C-7 varieties. In 2000, this company initially imported 440 tons of C-5 and 500 tons of C-7 hybrid corn seed from India. Currently PT BS marketed its C-9 corn seed variety in Sumatra Island. All corn varieties released by Global-3 are presented in Table 5. Along with the import of hybrid corn seeds, Global-3 also imported company parent seed from Thailand and the Philippines for propagation in Indonesia. In 2000, Global-3 imported 300 tons of parent material corn seeds. In 2001, the company collaborated with 7 farmers' groups of 70 members to produce corn seeds in an area covering 60 ha in the Klaten regency, Central Java province.

Besides producing hybrid and composite corn seed varieties, Domestic-1 also produced sweet corn. The hybrid corn seed varieties produced were C-1, C-3, Semar-2 (S-2), and Semar-3 (S-3). Both C1 and C3 were corn seed varieties generated by Global-3. On the other hand, the S-2 and S-3 were varieties invented by the Agency for Agricultural Research and Development (AARD).

AARD developed two composite corn seed varieties, i.e., Arjuna and Bisma. From 1995 to 1999, most of corn seeds produced and sold by Domestic-1 were hybrid varieties. The ratio changed in 2000 to 2001 when the company's volume of sales included composite corn varieties. Until 2001, Domestic-1 marketed C-1 and C-2 hybrid corn seed varieties. During the fourth quarter of 2002, this company sold the SHS-1 and SHS-2, both hybrid seeds. Both SHS-1 and SHS-2 varieties were developed by Syngenta Thailand and Domestic-1 has the rights to produce and market them in Indonesia. Syngenta Thailand is a company formed from the merger of Novartis and Seneca (PT Sang Hyang Seri, 2002).

Domestic-1 also produces and sells the hybrid corn seed varieties invented by Asian Hybrid Seed Technologies, Inc. (AHST), a company based in Davao, the Philippines (Department of Trade and Industry Philippines, 2002). Their corn seed varieties were named Jaya-1, Jaya-2, Jaya-3, and NKRI.

The corn seed produced by Domestic-2 was a composite or open pollinated variety (OPV), named Bisma. It purchased the corn stock seed from the BBI (Main Seed Farm) in Malang, East Java. During its last season in 2001, the company produced 48 tons of Bisma corn seed with a market value of Rp 144 million or around U.S. \$ 16,000. The corn seed production area of the company belonged to the contract growing farmers. The company could satisfy all of the market demand because it produced corn seed that supplied the requirement of government projects which absorbed 90 percent of its production. The remaining 10 percent was sold in the free market. In 1998, the company produced 150 tons of Bisma corn seed but 5 tons of the total corn seed production was unsold. In 1999, the company produced 70 tons of the composite corn seed variety. On the subsequent year, it produced only 25 tons but again increased to 40 tons in 2001 (Table 5).

Table 5. Corn Seed Production of Local Producers in East Java, Indonesia, 1999-2001 (tons)

Year	Domestic-2	Domestic-3	Domestic-4
1998	150	150	200
1999	70	150	200
2000	25	40	60
2001	40	40	90
2002	40	40	60

Besides producing Bisma corn seed, Domestic-2 formerly produced the S-2 hybrid corn seed varieties since 1998 and the S-3 since 1999. The parent materials were acquired from the Research Institute for Beans and Tuber Crops (Balitkabi) in Malang. Due to the poor performance of the S-2 and S-3 varieties brought about by poor corn seed processing, the corn growing farmers avoided using both hybrid varieties. Since 2000, the company has stopped producing them and at present, this producer propagates the Bisma corn seed.

For the last three years the corn seed production of Domestic-3 decreased to around 30 to 40 tons per year, compared with the previous years, i.e., 1997-1999, when production reached 100 to 200 tons per year. The decline was due to the lack of government projects for food crop production development. The company sold its corn production mainly in East Kalimantan province (80 %) and the rest was marketed in Java Island.

The corn seed currently produced by Domestic-4 was a composite variety of Bisma. In 2000, the company produced two tons of S-2 hybrid corn

seed variety. In 2001, it produced 90 tons of the Bisma variety and 60 tons of the same variety in 2002. The company has 20 hectares of corn seed growing areas owned by the producer's family. Its production could supply at least 90 percent of market demand. The rest was bought from other producers at a price of Rp 2,900/kg with its selling price of Rp 3,000/kg.

Domestic-5 produced two hundred tons of A4 hybrid corn seed in Solok Regency, West Sumatra Province. All of the corn seed growing and processing activities were supervised by the Food Crops and Horticulture Seed Control and Certification Service (SCCS) Region V Bukit Tinggi, West Sumatera.

CR₄ of the wholesaler-retailers was 50 percent (Table 6). On the other hand, CR₄ of retailers was 35 percents. This showed that corn seed market at the wholesaler-retailers' level in the province was oligopolistic because the CR₄ value was greater than the threshold for relatively competitive market of 40 percent (Parker and Connor, 1979). Conversely, the corn seed retailers were relatively competitive as shown by their CR₄ that was lower than 40 percent. This was because several of the wholesaler-retailers were also the distributors of Global-1, Global-2, and Global-3. The first three wholesaler-retailers sold 42 percent of overall volume of sales, while, the four biggest retailers' volume of sales accounted for only 35 percent.

Table 6. Concentration Ratio of The Four Biggest Firms, Hirschman-Herfindahl Index, Entropy Index, and Gini Index of Corn Seed Sales in East Java, 2002

Parameter	Wholesaler-Retailer (n=32)	Retailer (n=75)
CR ₄ (%)	50.27	34.85
Hirschman-Herfindahl Index	0.086	0.046
Entropy Index	1.227	1.538
Gini Index	0.536	0.586

Hirschman-Herfindahl Index of the wholesaler-retailers was 0.09 and that of the retailers was 0.46. An index closer to the value of 0 indicates that the traders are more equal in their volumes of sales. The bigger the index or the closer it is to 1, the more unequal the traders will be. The indices showed that the retailers were relatively more unequal in volumes of sales than the wholesaler-retailers.

Wholesaler-retailers and the retailers had Entropy Indices of 1.23 and 1.54, respectively. The closer the index to the logarithm of the sales volume, the more equal the traders are. The indices indicated that both wholesaler-retailers and retailers were almost equally comparable, but the EI of the retailers was closer to the logarithmic value of volume of sales.

Gini Indices of the wholesaler-retailers and the retailers were 0.54 and 0.59, respectively. A Gini Index of more than 0.4 revealed that both wholesaler-retailers and retailers did not have equal market shares.

Product Differentiation

Global-1 differentiated corn seed through differences in varieties. On the other hand, the consumers differentiated corn seeds through labels and packaging. Modern facilities owned by the company, such as laboratories, enabled Global-1 to differentiate their corn seed varieties not only physically but also genetically. Global-2 could differentiate corn seed not only through varieties and its field performance, but also its genetic character. On the other hand, the consumers usually distinguished corn seed through seed label and packaging. The firm's product differentiation activities were facilitated by its genetic purity test laboratory for corn seed variety in Pandorf, Austria (PT DI, 2001).

Domestic-1 implemented product differentiation through differences in varieties, packaging, label, and price. The farmers distinguished corn seed through varieties, and price. Furthermore, the farmers differentiated corn seed through the actual performance based on its productivity and resistance to pest and disease. Domestic-2, Domestic-3, and Domestic-4 could differentiate corn seed through the types of variety using genetic engineering technology. On the other hand, consumers distinguish corn seed using visible characteristics like the length of grain, labels and packaging. The producers had capability to distinguish corn seed by type of variety and the genetic technology used because of his long experience in producing corn seed.

In general, wholesaler-retailers differentiated corn seed products based on their varieties through various indicators. The prominent indicators included the seed type, product packaging, label, and seed weight. The retailers distinguished corn seeds based on the packaging, seed type, and label. All commercial seeds in the market were packed in plastic bags with brands, company logos, name of variety, and the seed labels on the outer plastic bags. Thus, the easiest way to recognize the corn seed products was through external appearance of the plastic bag.

Consumers at the wholesaler-retailers' and retailers' levels distinguished the corn seed products through the packaging and label. Consumers also used grain length and weight as additional indicators. Very few consumers knew the product based on its harvest period. The traders and the buyers were not allowed to open the plastic bag if they had not yet paid for the corn seed. When the plastic bags have been opened, the producers would not replace them with the new seeds especially when the validity of label has already expired. The seed type and its weight would be recognizable if the plastic bag was open. To some extent, the traders or retailers have difficulty in distinguishing varieties with the same brand. For example, the Pioneer corn seed varieties look identical in

their outer appearances. In a similar manner, the illegal seeds, which are sold without any standard packaging nor any indication as to the variety, depends on the supplier informing the traders, who, in turn would have to inform the consumers what variety of illegal seed they are selling.

Market Knowledge

Seed companies in Indonesia periodically updated themselves on the reactions and preferences of the target markets through various means of feedback mechanisms in order to either maintain or increase their individual market shares.

Global-1 assessed consumers' tastes and preferences for corn varieties through market research. This firm fields salespersons whose jobs included selling the corn seed products and providing information to their company about consumers' opinions or complaints on their product lines, based on informal reports from the traders and the mass media. To some extent, this information was one-sided as they only described the farmers' views on the corn seed products sold in the market. In order to reach a greater number of consumers, the company employed various information campaign strategies, which include field demonstration and trials for their corn seeds. This function was performed by the field extension workers who coordinate with the agricultural service offices at the regency and provincial levels to put up demonstration plots. On the other hand, top company officials regularly attended scientific meetings sponsored by government and non-government organizations, to participate in strategy formulation or to discuss recent developments in corn production.

Market research was likewise conducted by Global-2 to assess consumers' preferences on corn seed products. Their salespersons gathered information on specific characteristics of corn seed preferred by consumers and the weaknesses of their own product. Information was also gathered on policies affecting corn production in the country, particularly the government's stance on the recent hybrid corn production technique like the genetically modified organisms (GMO). Company officials were expected to be proactive and to attend seminars on developments in the domestic corn agribusiness sector.

Domestic-1 appraised consumers' demand through information received from the traders. However, the company spends more time to lobby with officials who could influence the government's procurement of corn seeds rather than on farmers' preference. Most of the corn seeds produced by the company are sold to government projects. Thus, the producer does not have field extension workers or salespersons to gather consumers' preference on its products and both the corn seed traders and farmers could not complain directly to the seed producer.

Similarly, other producers used their contracts with government agencies to determine the volume of their corn seed production of specific

varieties. Information on the market demand was acquired by lobbying with the Agricultural Service officials either at the provincial or regency levels. Producers were proactive in pursuing purchase orders either directly from the buyers or indirectly through brokers.

Some local producers used the previous season's sale to estimate their sales volume for the next season. For example, government projects for the planting of corn on irrigated farmlands were usually implemented during the dry season and the same projects for dry land are carried out on wet seasons. Seed producers maintained good relationships with corn seed distributors as an important way to distribute their production.

All corn seed traders tried to sell corn varieties based on the level of demand they deduced from the market. Several factors that affected demand were used as bases for demand assessment by both wholesaler-retailers and retailers. The traders also observed the corn varieties that are extensively grown in the corn growing areas. Another method employed was gathering information from other corn seed traders and from the seed companies. As a matter of policy, the seed companies do not provide information directly to the traders but through their sales people. It was observed that no single variety could perform well in all regencies or sub regencies due to differences in agro-ecosystem. Thus, a popular variety in a particular area might not be as favorably accepted in the other areas.

Information from government institutions like the Agricultural Services, was rarely available except to the traders who directly supplied them the corn seed for government projects. The farmers had the freedom to choose the variety of corn that they desired. Recommendations from government agencies did not specifically endorse any particular brand of corn seed.

Barriers to Entry and Exit

Barriers to entry between the multinational and local firms could be gleaned in terms of the production cost, selling price, profit and yield of corn seed (Table 7). Multinational firms produced mainly the hybrid varieties compared to the local firms who produced the composite varieties. Average production costs of multinational companies were greater (Rp 6,200/kg) than the local firms (Rp 2,160/kg), although in certain instances, the average yield obtained by the multinational companies were lower (3.2 tons/ha) than what the local firms obtained (4.3 tons/ha). Nevertheless, the higher selling price of Rp 19,000/kg for the hybrid varieties compared to Rp 3,400/kg set by the local firms for their products, earned for the multinationals higher profits. Domestic-1 produced the high-yield Semar-3 hybrid corn variety at a lower production cost but it got lesser profits due to its lower selling price. The hybrid corn seed varieties sold by the multinational firms commanded a higher selling price due to its better quality particularly in terms of crop yields.

Table 7. Barriers to Entry of Corn Seed Producers in East Java, 2002

Producer	Variety	Production Cost (Rp/kg)	Selling Price (Rp/kg)	Profit (Rp/kg)	Yield (tons/ha)
Multinationals					
- Global-1	Hybrid ¹	6,195	18,038	11,843	3.39
- Golbal-2	Hybrid ²	6,209	20,000	13,791	3.00
Average	Hybrid	6,202	19,019	12,817	3.19
Local firms					
- Domestic-1	Composite ³	3,044	4,500	1,456	3.36
- Domestic-2	Composite ³	1,787	3,000	1,213	5.00
- Domestic-3	Composite ³	1,965	3,375	1,410	4.00
- Domestic-4	Composite ³	1,860	2,750	890	5.00
Average	Composite	2,164	3,406	1,242	4.34
Local firms					
- Domestic-1	Hybrid ⁴	4,392	8,000	3,608	4.20

Notes: 1) BISI varieties, 2) Pioneer varieties, 3) Bisma variety, 4) Semar-3 variety
The existing exchange rate was US \$ 1 to Rp 9,000

The main barrier to entry into the corn seed industry faced by Global-1 was its high capital requirement. Other barriers included the ability of the firm to conduct market research and to recruit capable breeders. Consequently, the large capital investment becomes the main barrier to exit from the corn seed industry. Investments included experiment stations, seed processing plants, establishment of the marketing company, and all other expenses incurred in generating new varieties. Nonetheless, this company gained a significant portion of the market share since it started to launch hybrid corn varieties in the early 1980s, namely, the CPI-1 and CPI-2

The main barrier to entry into the corn seed industry encountered by Global-2 was the large capital requirement needed to develop its human resource for its breeding program, seed production, and marketing activities. Similarly, the main barrier to exit from the industry was the large capital invested and the potential profits to be earned from the industry.

Domestic-1's barrier to entry into this industry was the large amount of capital to recruit qualified breeders. So far, this company only produced and sold corn seeds but had never introduced new varieties. The company was reluctant to exit the seed industry as it has an established market and expected high profit. However, despite its captive market and frequent government capital infusion, Domestic-1 always incurred losses annually.

The main constraint encountered by Domestic-2 and Domestic-3 to enter the corn seed business was the large capital requirement, either the cash

for the purchase of variable inputs or for its fixed assets such as vehicles, warehouses and processing facilities. Knowledge of the industry and experience in seed processing were other constraints. Knowledge is acquired over time from its experiences which included trials and errors. To exit from this industry, the producer had to deal with the main constraint posed by its large investment in the business coupled with its reluctance to give up its share of the lucrative seed corn market.

A major barrier to entry faced by Domestic-4 into the corn seed industry was the declining demand for seed corn over the last years due to the decentralization program initiated in Indonesia since 2000. This devolved the powers of the central government to local government units and fragmented the solid market for government purchases of seed corn as the projects had to be financed by the local governments. Unfortunately, the financial capabilities of the local governments were relatively weaker compared to that of central government. The continuing demand for corn seed serves as the main barrier to exit from this industry and indicated that the producer was still able to earn profits from producing corn seed.

As in most markets, barriers existed for new investors intending to sell commercial corn seed. The biggest being the high amount of capital required to start the business. Start-up business needs investment for the stores or kiosks and costs of seed purchase. Furthermore, it was difficult to carry a single brand of corn seed. Most corn seed traders sold other agricultural inputs, such as fertilizers and pesticides. Thus, the new entrant would need additional capital to purchase other products for sale. While the growing demand for commercial corn seed will attract many new entrants, the stiff competition in the market and the additional number of sellers would mean declining profits over time. The incoming entrants could also mean stagnant sales for some established traders. Due to the number of sellers who would vie for the loyalty of consumers through varied means, it would not be easy for new traders to convince consumers to shift their allegiance.

There were many factors that affected their economies of scale. Among these were the volume of sales, total marketing cost, average marketing cost, and investment level (Table 8). On average, the volume of sales of the wholesaler-retailers (47.3 tons) was significantly greater than that of the retailers (5.3 tons). Consequently, the total marketing costs of the wholesaler-retailers was also higher compared to that of the retailers because 99 % of the marketing costs consisted of the purchase value for corn. Accordingly, the higher sales volume of the wholesaler-retailers led to lower average marketing cost. On the other hand, to start their business the wholesaler-retailers had to invest more capital than the retailers.

Increasing demand and huge profits were among the reasons for both the retailers and the wholesaler-retailers to stay in the corn seed business. This implies that most of the wholesaler-retailers can improve their market share

overtime, besides few of them mentioned constant demand. Furthermore, some wholesaler-retailers could avail of credit from corn producers without collateral. The large investment also deterred traders from exiting the industry. The continuous demand and expectation of huge profits were significant barriers for retailers to exit this business. Besides, the corn seed business was an income generating activity for some retailers who have other sources of income.

Table 8. Factors Affecting Economies of Scale of Wholesaler-Retailers and Retailers Engaged in Corn Seed Trading in East Java, 2002

Item	Wholesaler-Retailers (n=32)	Retailers (n=75)	Difference
Volume of sales (kg)	47,303	5,314	41,989 ***
Total marketing costs (Rp)	868,299,489	100,924,055	767,375,433 ***
Average marketing cost (Rp/kg)	18,356	18,992	-636 **
Investment (Rp/trader)	184,952,094	33,392,840	151,559,254 ***
Minimal investment (Rp)	15,415,000	515,000	
Maximal investment (Rp)	908,000,000	184,800,000	

Note: ***, **, * are significantly different at 1 %, 5 %, and 10 % levels, respectively
The existing exchange rate was U.S. \$ 1 to Rp 9,000

CONCLUSIONS

Conclusions

The market structure of this industry at the producers' level was highly oligopolistic, where the multinational companies dominated the market share. Two major corn seed varieties were sold, namely, hybrid and composite varieties. Hybrid varieties were more popular than the composites due to their higher yields. The local producers could differentiate corn seeds from their outer appearances, but the multinationals were also able to differentiate the products genetically. All producers were well informed about the market from the information they gathered through market research. The large investment was the main barrier to entry to the industry. In terms of economies of scale, although the multinationals incurred higher average production costs, they could set higher selling prices with much greater profits. Meanwhile, established market shares and significant profits were the main barriers to exit from the industry.

The market structure of the corn seed industry in East Java province was oligopolistic at the wholesaler-retailers' level and relatively competitive at the retailers' level. Differentiation of corn seeds was carried out by both the

traders and the buyers through their packaging and seed labels. The traders were well informed about their market from the knowledge they acquired from the producers and the other traders. The capital requirement was a major barrier to entry to the corn seed business and established market share was the main barrier to exit. Higher investment enabled the wholesaler-retailers to purchase more volume of sales and lower their average marketing cost per kg.

Some of the wholesaler-retailers were selling corn seed commodities along with other agricultural inputs. Some wholesaler-retailers marketed their corn seeds and agricultural inputs to government projects by lobbying with its officials. This method of sales was less profitable than selling directly to common buyers due to relatively higher transaction costs and delayed payments.

Policy Implications

The price of hybrid corn seeds tended to increase over time due to the relatively oligopolistic nature of the market at the producers' level. The government could not intervene in the industry because it does not provide subsidy to the multinational companies. The hybrid corn seed industry tends to become oligopolistic due to the ability of the multinational firms to control the technology and the germplasm for seed propagation, deterring the entry of new firms. The local companies cannot cope up with the competition from the multinational companies due to lack of budget and innovations especially in research and development. The government has to encourage new companies into the industry in order to lessen monopolistic power in the market. It will make improved varieties of corn more affordable to the farmers. Thus, it will encourage the farmers to adopt improved varieties of corn. In addition, it would be better for the AARD to assign exclusive rights of the corn varieties it invents to the seed producers in order to promote and market the corn seed varieties, subject to certain royalties.

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