

Full Length Research Paper

Performance efficiency of the liberalised agricultural pesticide marketing system in Ghana

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The Structural Adjustment Program in 1983 liberalized the procurement and delivery of agricultural inputs in Ghana to reduce government interventions. This study was designed to assess the post-liberalized performance of the agricultural pesticide marketing system in Ghana. The investigation was conducted in the Humid Agro-ecological zone, comprising Ashanti, Central, Eastern, Brong Ahafo and Western Regions of Ghana. A multi-stage sampling technique was employed to enumerate 87 pesticide dealers comprising 10 wholesalers, 2 industrial distributors and 75 retailers. Primary data were collected using structured questionnaires from the selected pesticide dealers, through personal interviews, in March 2010. Besides descriptive statistics, correlation and t-statistics, profitability model implying deconstructed market margins was used to examine the profitability and performance efficiency of the system within the structure-conduct-performance framework. Though the market was found profitable, it was not efficient in ensuring equality in vertical and horizontal profit distribution. As a result, the market could not ensure efficient distribution of pesticides to remote areas due to low profitability. Low level of education coupled with lack of technical backstopping to upgrade knowledge of pesticide dealers rendered the system inefficient in giving quality technical advice on safe use and handling of pesticides. Dealers understanding of pesticide characteristics were limited. They did not exhibit knowledge of safe use and handling of pesticides. Authorized measures to prevent harmful effects of pesticides were not complied. Pesticides were repacked without labels, trade names and application rates. Inadequate effort in enforcing regulations and maintaining the efficacy and shelf life of pesticides was found.

Key words: Agricultural pesticides, performance efficiency, deconstructed market margins, vertical and horizontal profit distribution, structure-conduct-performance model.

INTRODUCTION

Until 1983, the procurement and delivery of agricultural inputs in Ghana were solely handled by state institutions. The motive for entering this field, according to World Bank (1993), was that agricultural inputs were seen as vital commodities that should not be left to the care of the private sector, which was regarded as exploitative and unreliable. Private sector unaided is incapable of achieving the necessary quality standard and that only by public distribution will inputs be made available to the remote areas that the private trader was assumed to neglect because of low profitability. However, during this era, the marketing parastatals, which were set up and expanded by the state, performed very poorly. Some of

the typical weaknesses enumerated by Scarborough and Kydd (1992) include:

- Inadequate and untimely supplies of production inputs.
- Lack of innovation resulting from absence of competition.
- Unreliable access to marketing facilities.
- Poor quality control.

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More so, marketing parastatals obtained few of the benefits of being government departments, while suffering many of the disadvantages. Governments have lacked effective mechanisms to make parastatal marketing boards accountable for their performance. Additionally, parastatals have been subject to political control to a greater extent than the private sector, by virtue of their location within the public sector.

One of the main objectives of structural adjustment has been to reduce distortions through reductions in government intervention, a process referred to as market liberalization. Therefore, the Structural Adjustment Program recommended the liberalization of the procurement and delivery of agricultural inputs in Ghana. There have been a number of unempirical post-liberalized complaints by farmers of the efficacy, availability and prices of agricultural pesticides. This might be attributable to poor market performance. However, not much is known about the state of the agricultural input marketing system after its privatization. Regardless of what economic system the society chooses, a marketing system that meets the needs of its citizens must be developed. Accomplishing this objective, as Beierlein and Woolverton (1991) have stated, determines to a great extent the level of consumer satisfaction in the general economy. Therefore, this study was designed to empirically examine the profitability and performance efficiency of the liberalised system of agricultural pesticide marketing in Ghana. The analysis was expected to produce results that may guide the formulation of policies directed at improving the performance of the market. According to Gyasi and Uitto (1997) and MoFA (2000), the humid agro-ecological zone comprising Ashanti, Central, Eastern, Brong Ahafo and Western Regions of Ghana has the greatest agricultural potential and is the major producer of food crops in Ghana. This coupled with high incidence of pest, owing to high rainfall and humidity (Fajinmi, 2009), which requires high-level usage of pesticides in the area, has provided a justification for conducting the study in the humid agro-ecological zone of Ghana.

The market structure-conduct-performance model

The market structure-conduct-performance (SCP) model originates from industrial dynamics theory and illustrates how intermediaries may influence markets in different ways (Shepherd, 1985). Shepherd conceptualizes the dynamics of markets by relating market structure, market behavior (conduct) and market performance to external factors, assuming that market structure and conduct of market participants influence each other, and finally determine the performance of markets.

Market structure can be described by the numbers and size distribution of firms (including intermediaries), market shares, concentration, and entry barriers (Harris, 1993). Market behavior is determined by the strategies of the

different players in a market and the way in which strategies are implemented in intra- and inter-organizational business processes to execute market transactions (Smits and Janssen, 2008). Market performance represents the economic results of structure and conduct, in particular the relationship between distributive margins and the costs of production of marketing services (Harris, 1993). Lutz and Tilburg (1997) included level and seasonality of prices, and level and distribution of profits among market participants.

Market structure affects market performance and the influence can either be direct (for example, in a monopoly the market structure influences prices) or indirect (for example, the presence of certain actors in the market can influence competitive behavior, ultimately influencing prices). Shepherd explains a feedback relationship; for example, when a firm makes good profit with a certain product offering, this can lead to new behavior of other market participants and new market entrants. Also, changes in market structure, behavior and performance can lead to changes in external determinants (like government policies).

Market performance

Market performance is a key concept in the Shepherd model. After having conducted an extensive literature and web search, Smits and Weigand (2010) conclude that the term "market performance" is not much used as such in economics and business literature. The performance of a market should describe "how well a market does", but it needs to be clarified in which categories and dimensions 'good performance' can be measured. In recent economists' work, it is acknowledged that it is important for different stakeholders like theorists, policy makers and entrepreneurs to have objective ways to measure market performance of different market types (Friedman, 2007). Economists traditionally understand a well doing market as one in which the allocation of supply and demand works most efficiently, which means that maximum earnings are achieved for each participant. An efficient market may be one that benefits overall welfare, but it is also clear that gains for one group of market participants often mean losses for another group. Identifying factors that influence the costs and benefits of certain markets for different participants and that constitute market performance is thus a complex undertaking and requires simplification in order to keep analysis tractable (O'Hara, 1995). For analysis, Smits and Weigand (2010) used the classification of market performance outlined by Shepherd. According to Shepherd (1985), the performance of a market is determined by 4 performance goals: (1) the efficiency of the allocation of resources in the market, (2) the technological progress that can be witnessed, (3) equity in distribution of resources, and (4) other dimensions like cultural factors. The four goals are summarized in Table 1.

Table 1. Market performance goals according to Shepherd (1985).

Efficiency of resource allocation	(a) Internal efficiency: Firms are well managed, drawing maximum effort from employees and avoiding any slack in operations (firm level efficiency). (b) Allocative efficiency: The economy's total resources are allocated among goods to maximize total output. No revision of production could raise the value of output. In all firms, prices are set equal to long-term marginal cost and average cost (network level efficiency).
Technological progress	The advance of technology and its uses in practice are as rapid as possible.
Equity in distribution	There is a fair distribution (in line with the society's standards) of wealth, income and opportunity.
Other dimensions	Such other values as individual freedom of choice, security from extreme risk, and cultural diversity are provided.

METHODOLOGY OF THE STUDY

Sampling technique

The study was designed to focus on agricultural pesticide marketing in Ghana, particularly on some of the major food crop producing regions where pesticide use was high. The target groups were importers, wholesalers, distributors and retailers of pesticides. The study covered parts of the Ashanti, Eastern, Western, Brong Ahafo and Central Regions of Ghana. These regions, according to MoFA (2000), form part of the major food producing areas in Ghana. A reconnaissance study conducted on the spatial market network in the study area revealed a wholesale market in Kumasi linking several retail markets in Kumasi and other district markets in the study area. Each district market was found to be surrounded by satellite retail markets. Kumasi was then chosen as the reference market for the study.

A multi-stage sampling technique was employed to enumerate 87 pesticide dealers across the study area. Purposive sampling was first used to select Kumasi, the reference market, and 2 district markets from each of the five major food producing regions. These markets were chosen due to their proximity and common trade link to the reference market. From the reference market, 15 retailers were randomly selected and the only 10 importer/wholesalers and 2 industrial distributors were also selected. Cluster sampling was then used to select all pesticide dealers in each of the 10 district markets. The district markets selected and the sample distribution are shown in Table 1. Using structured questionnaires, cross-sectional data were collected from the selected pesticide dealers through personal interviews in March 2010.

Analytical framework

We have chosen Shepherd's industrial dynamics theory for performance assessment because it focuses on the

dynamic interactions between market structure, conduct, and performance (SCP) and on the development of markets over time. Within the SCP model, performance indicators for agricultural pesticide marketing in Ghana were formulated based on Shepherd's performance goals enumerated in Table 1. Folayan et al. (2007) used profitability as a measure of marketing performance in Cocoa marketing in Nigeria. They concluded that if profitability is positive, the market is confirmed to perform efficiently. If the market is efficient, participants earn normal profit (Abbott, 1973) and all of them are equally compensated for the resources employed (Bateman, 1976). Hence a significant difference in profitability between the retail and the wholesale levels would indicate an inequality in vertical distribution of profit. On the other hand, a correlation between the retail profit level and the distance between the retail market and the wholesale market would also indicate an inequality in horizontal (spatial) distribution of profit.

Pesticides Control and Management Act (Act 528), 1996 in Ghana requests pesticide dealers as well as farmers to comply with regulatory measures that ensure safe use and handling of pesticides. If a market performs efficiently, institutions exist to enforce these regulations, appropriate surveillance and monitoring. Jones (1993) has stated that marketing institution provides market information, engage in market research, promote sales and do technical work on quality control to enhance market performance. Institutions also have social rules, norms and conventions which determine the nature of social interaction (Bardhan, 1989; North, 1990). As stated by Smits and Weigand (2010), if the rules of the market cannot be enforced by certain mechanisms or authorities, market mechanisms (conduct) might not work accordingly, and this lowers market performance. Where equity and employment creation are national objectives, these are also considered as criteria for performance assessment (Marion and Mueller, 1983).

Based on the Pesticides Control and Management Act (Act 528) and the Shepherd's performance goals,

Table 2. Sample size distribution.

Region	District market	Sample size			
		Retailers	Wholesalers	Industrial distributors	Total
Ashanti	Konongo	4	-	-	-
	Bekwai	3	-	-	-
	Kumasi (Ref. Market)	15 (40)*	10	2	-
Eastern	Nkawkaw	6	-	-	-
	Akim Oda	7	-	-	-
Western	Bibiani	6	-	-	-
	Sefwi Wiawso	6	-	-	-
Central	Assin Fosu	7	-	-	-
	Twifo Praso	5	-	-	-
Brong/Ahafo	Bechem	4	-	-	-
	Techiman	12	-	-	-
Grand Total		75	10	2	87

* 15 retailers randomly selected out of 40.

performance indicators of pesticide marketing have been chosen in Table 3 as a modification of that used by Lutz and Tilburg (1997) and Smits and Weigand (2010). As indicated by Bateman (1976), the usefulness of the framework of assessment rests on its ability to command general acceptance and shed light on some explicit goals of the society. *The functional parameters* are key descriptors of how the system should operate and combine characteristics related to market structure and conduct. The *performance indicators* are parameters that permit assessment of the performance of the system.

Analytical procedure

Besides the use of descriptive statistics, profitability model that uses deconstructed market margins, correlation and t-statistics were employed to examine the performance indicators outlined in Table 2. Correlation and t-statistics were used to assess equality in horizontal and vertical profit distribution.

Deconstructed market margins and profitability model

Returns on investment, according to Abbott (1973), is the 'normal' profit representing the least payment the owner of an enterprise would be willing to accept for performing the entrepreneurial function, including risk taking, management and the like. Returns on investment is given as gross value of output (that is, total revenue) less total costs incurred and this represents deconstructed market

margin since gross margin is partitioned into revenue, cost and returns on investment. Gross market margins cannot be treated as indicators of economic performance because they represent the sum of costs incurred by, and the returns to, market participants. Large gross margins may give a misleading impression. This is because they may be associated alternatively with high cost and low profits (that is, Returns), increased quantity or qualities of marketing services, or high rates of profit. Similarly, large margins can be associated with low capital, labor or management productivity as a result of either monopoly control, and hence lack of incentive to reduce costs or increase productivity; absence of profit-maximizing behavior and/or with risk-reducing market strategies. Conversely, small gross margins may co-exist with inefficient use of resources, poor co-ordination and consumer satisfaction, and disproportionate profit elements. Having reviewed the limitations of gross market margins as indicators of economic performance, Scarborough and Kydd (1992) recommended the deconstructed market margins as more direct and reliable means of evaluating economic performance of markets. This allows comparisons to be made between marketing enterprises (along market channel), and between the returns to capital invested in different sectors of the economy (Harris, 1981).

Profitability is the rate of returns to capital employed in agricultural commodity marketing as has been defined by Harris (1981):

$$\pi = \frac{R-TC}{CS+WC} \times 100 \text{ ie } \pi = \text{Profit (or returns)/Capital employed}$$

Table 3. Performance indicators for characterising efficient pesticide marketing in Ghana.

Functional parameter	Performance indicator
Profitability of pesticide marketing	<ul style="list-style-type: none"> - Profitable reward (Folayan et al., 2007) - Normal profit (Abbott, 1973) - Equality in vertical and horizontal (spatial) distribution of profit (Bateman, 1976)
Competence and expertise of pesticide dealers	<ul style="list-style-type: none"> - Ability to read, understand and interpret labels on pesticides - Exhibiting knowledge of safe use and handling of pesticides - Awareness of health hazards caused by improper handling of pesticides
Quality service output in relation to supply and condition of pesticides	<ul style="list-style-type: none"> - Supplying preferred lot, size and quantity of pesticides through repackaging - Providing trade names, labels and application rates on repacked pesticides - Maintaining efficacy of pesticides by keeping them off direct sunlight - Delivering quality technical advice on safe use and handling of pesticides
Enforcement of pesticide regulation	<ul style="list-style-type: none"> - Enforcement of licensing - Enforcement of other regulations on safe use and handling - Compliance of precautionary measures to avoid harmful effects of pesticides

Where:

π = Profitability of pesticide marketing.

R = Annual turnover on the sale of pesticides (i.e. total revenue) in the period of review.

TC = Total costs incurred in the period under study (The relevant marketing costs of pesticides considered were: total cost of pesticides handled during the period under review; cost of transferring pesticides to destination store; cost of repacking pesticides; cost of running pesticide store; fees, commissions, taxes and tolls; opportunity cost of working capital; opportunity cost of capital stock; depreciation of capital stock).

CS = Value of capital stock, including land, buildings and machinery, etc., at the period under review.

WC = Value of working capital used during the period of study.

The most ideal rate for opportunity cost, the shadow interest rate, could not be used due to its computational difficulties arising from high and unstable inflation rate in the economy. The opportunity cost was, therefore, pegged at 43% pa, which represented the cost of capital in the year under study. Depreciation was calculated at 20%, using the straight-line method. Risk was eliminated in the analysis because the Pesticides Control and Management Act (Act 528) have recommended measures to guard against risks which are common to pesticide handling.

Profitability was calculated using the means of the annual values of the previous year (that is, 2009). It was hypothesised that profitability is greater than zero and relatively lower in the remotest area. Since African governments initially considered private delivery of agricultural inputs as exploitative (Scarborough and Kydd, 1992), the *a priori* expectation was that pesticide dealers make excess profit.

RESULTS AND DISCUSSION

The results of the study have been discussed under four broad topics that are outlined in Table 3.

Profitability of pesticide marketing

The profitability of marketing enterprises is one of the indicators of the degree of competitiveness and equality in the system. Table 4 shows profitability of the entire pesticide marketing as well as the retail and wholesale profitability levels. The mean marketing cost for the entire market over the year of study was GH¢142,200.00 and the mean turnover on the sale of pesticides was GH¢144,900.00. The mean capital stock for the market was GH¢436.59, while the mean working capital was GH¢5,968.71. Profitability for the entire market using the profitability model is 42.15% which is greater than zero but almost equal to the prevailing cost of capital. Using t-

Table 4. Deconstructed marketing margins and profitability of pesticide marketing.

Type of dealer	TC (GH¢)	R (GH¢)	CS (GH¢)	WC (GH¢)	R-TC (GH¢)	CS +WC (GH¢)	$\pi(\%)$
Retailer							
N	75	75	75	75	-	-	
Minimum	6,000.00	6,125.10	100.00	170.00	-	-	
Maximum	351,488.00	355,197.00	450.00	7,200.00	-	-	
Mean	81,611.50	82,973.84	270.80	2,385.47	1,362.34	2,656.27	
Std. deviation	34,344.72	45,464.19	138.36	1,534.79	-	-	
π_R							51.29
Wholesaler							
N	10	10	10	10	-	-	
Minimum	278,250.00	292,220.00	1,000.00	11,000.00	-	-	
Maximum	994,250.00	1,018,250.00	3,000.00	76,000.00	-	-	
Mean	596,500.00	609,200.00	1,680.00	32,800.00	12,700.00	34,480.00	
Std. deviation	261,500.00	266,100.00	576.00	24,100.00	-	-	
π_W							36.83
Pulled sample							
N	85	85	85	85	-	-	
Minimum	6,000.00	6,125.00	100.00	170.00	-	-	
Maximum	994,250.00	1,018,250.00	3,000.00	76,000.00	-	-	
Mean	142,200.00	144,900.00	436.59	5,968.71	2,700.00	6,405.30	
Std. deviation	83,600.00	97,600.00	210.89	2,900.00	-	-	
π_P							42.15

Source: Computed from survey data, 2010; R = Annual turnover on the sale of pesticides; TC = Total marketing costs incurred in the period under review; CS = Value of capital stock, including land, buildings and machinery at the period under review; WC = Value of working capital used during the period of study; π_R , π_W , π_P = Profitability of pesticide marketing for retailers, wholesalers and the entire market respectively; $t < 0.05$.

test, the null hypothesis that profitability is greater than 0% was accepted at 1% significant level. This is a normal profit since the profitability of 42.15% is almost the same as the interest rate of 43% in the financial market at the time of the study. This defies the *a priori* expectation that private pesticide delivery is exploitative, since Abbott (1973) stated that cost and profit margins must approach the level that is just sufficient to reward investment at the going rate in the financial market. Even though the mean working capital for the entire market is GH¢5,968.71 and the minimum is as low as GH¢170.00, they realized high profitability due to low capital stock requirement. The maximum and minimum values of capital stock employed in pesticide marketing were GH¢3,000.00 and GH¢100.00 respectively. The high profitability was also attributed to the fact that pesticide dealers could turnover their working capital several times in a year.

Vertical and horizontal distribution of profits

It could be inferred from Table 4 that the retail profit level of 51.29% was significantly different and more than the wholesale profitability of 36.83%. The discrepancy

between the retail and wholesale profits was an indication of inequality in vertical distribution of profits. If the market was competitive, high retail profit might result in arbitrage that would reduce the retail profit and make it comparable to wholesale profit. Profitability was also seen to correlate negatively with the distance between the retail and the wholesale markets as depicted in Table 5.

A negative correlation indicates a decrease in profit as the distance from Kumasi (the wholesale market) to the remote areas increased. The trend reveals an inequality in horizontal (spatial) profit distribution. As distance between retail and wholesale (Kumasi) markets increased, profitability of pesticide marketing declined. The correlation result accepts the second hypothesis that profitability is relatively lower in the remote areas. It was observed that cost of transferring pesticides to remote areas increases with distance and poor nature of roads. However, as the prices of pesticides in the remote markets escalated, as a result of increased cost of transfer, pesticide users preferred buying from the bigger markets rendering the local markets less patronized. This creates a disincentive for entry into the retail market rendering it less competitive. This observation confirms

Table 5. Correlation between profitability and distance from wholesale (Kumasi) market.

Matrix	Profitability	Distance from wholesale market
Profitability		
Pearson's correlation	1.00	-0.434**
Sig. (2-tailed)	-	0.001
N	85	85

Source: Computed from Survey Data, 2010; **Correlation is significant at 1% level (2-tailed).

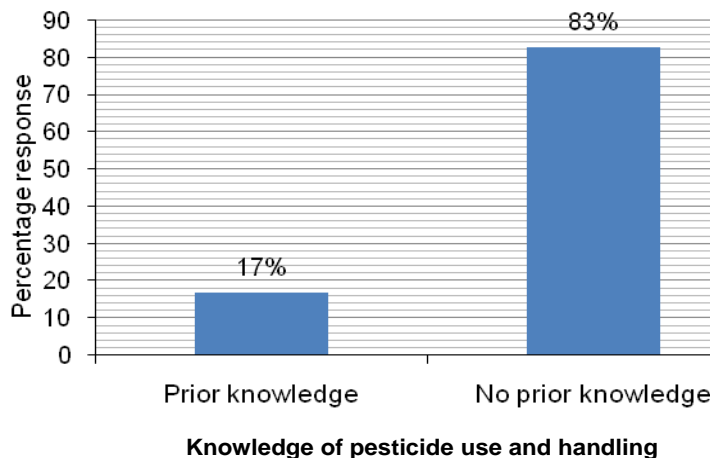


Figure 1. Dealers' prior knowledge of pesticide use and handling.

Table 6. Access to training and technical backstopping.

Access to training	Type of dealer						Pulled	
	Wholesaler		Retailer		Industrial distributor		Freq.	%
	Freq.	%	Freq.	%	Freq.	%		
Training	3	30	1	1	2	100	6	7
No training	7	70	74	99	0	0	81	93
Total	10	100	75	100	2	100	87	100

Source: Survey Data, 2010.

the World Bank (1993) statement that private sector neglects the remote areas because of low profitability in input distribution.

Competence and expertise of pesticide dealers

According to Pesticides Control and Management (Act 528) of Ghana, one must have the expertise, facilities and equipment for dealing in pesticides or demonstrate that one has easy access to consultancy, training and others before given license to operate as a pesticide dealer. Knowledge of safe use and handling of pesticides, ability to read and interpret pesticide instructions, practicing measures against health hazards posed by improper handling of pesticides are expected to

characterize pesticide dealers.

Knowledge of safe use and handling of pesticides

Figure 1 depicts whether or not pesticide dealers had prior knowledge on safe use and handling of pesticides before entering into the market. Almost all the dealers (83%) entered the market without prior knowledge of pesticide handling and use. Only 17% of them had some orientation on pesticides use and handling from relations and formal consultancy before becoming dealers. Upon entry, dealers lacked training and technical backstopping on safe use and handling of pesticides as it is evident in Table 6.

Although, some dealers of pesticides emerged during

Table 7. Educational background of pesticide dealers.

Educational level	Type of dealer						Pulled	
	Wholesaler		Retailer		Industrial distributor		Freq.	%
	Freq.	%	Freq.	%	Freq.	%		
No formal education	1	10	2	4	0	0	3	4
Basic education	1	10	45	60	0	0	46	53
Secondary/SSS	8	80	19	25	2	100	29	33
College	0	0	8	10	0	0	8	9
Tertiary	0	0	1	1	0	0	1	1
Total	10	100	75	100	2	100	87	100

Source: Survey Data, 2010.

Table 8. Provision of label, trade name and application rate on repacked pesticides.

Provision of labels, application rate, trade name	Type of dealer						Pulled	
	Wholesaler		Retailer		Industrial distributor		Freq.	%
	Freq.	%	Freq.	%	Freq.	%		
Labels, etc.	10	100	2	3	2	100	14	16
None	0	0	73	97	0	0	73	84
Total	10	100	75	100	2	100	87	100

Source: Survey Data, 2010.

the early stages of privatization, retailers in particular, as shown in Table 6, had limited access to business and technical training.

Majority of the dealers (93%) had not received business management and technical training on safe use and handling of pesticides. As a result they lacked technical understanding of pesticide characteristics and marketing skills. They exhibited lack of knowledge of safe use and handling of pesticides.

Ability to read and interpret inscriptions on pesticides

By Environmental Protection Agency (EPA) standard, pesticide dealers must understand pesticide labels and communicate effectively with customers to meet their needs. Labels on pesticides were either in English or French languages. The study assessed the literacy level of pesticide dealers, considering their level of education, and proficiency in English and French languages and the results depicted in Table 7.

As shown in Table 7, more than half (53%) of the dealers had attained basic level of education, which is as low as to enable them to read and understand pesticide labels which are technical. It was observed that 4% of the dealers had no formal education and the tendency to interpret pesticide labels wrongly was high. Only few (33%) had secondary education whilst 9% and 1% had college and tertiary education respectively. This

observation confirms that of Ekboir et al. (2002) when they assessed the characteristics of herbicide dealers in Ghana and found low levels of education among them. The general observation was that pesticide dealers were not technically skilled to interpret inscriptions on pesticides due to low level of education.

Service output in relation to farmer satisfaction

Service output expected of pesticide dealers were: making pesticides available for procurement, repackaging pesticides into smaller and affordable sizes and providing labels on them, protecting the efficacy and shelf life of pesticides; delivery of technical advice on safe use and handling of pesticides.

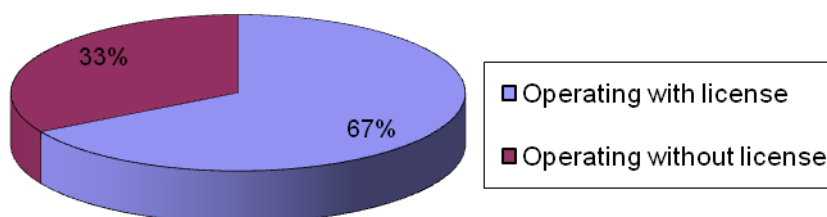
Provision of label and technical inscription on repacked pesticides

Most of the pesticides imported are packaged in bulk and are not easily affordable by small-holder farmers in that form. It has, therefore, been the practice of pesticide sellers to repackage them into smaller sizes that could be afforded by farmers. The study revealed that though all the pesticide dealers repacked pesticides into sizes that could be afforded by all farmers, majority (84%) of the dealers specifically retailers, as pointed out in Table 8, did not provide labels, trade names and application rate on the package.

Table 9. Protection of pesticides against sunlight.

Protection against direct sunlight	Freq.	%
Protection	60	69
No protection	27	31
Total	87	100

Source: Survey Data, 2010.

**Figure 2.** Possession of license in pesticide marketing.

Only few of the dealers (16%) provided labels, trade names and application rate on the packages. Since labels are sources of information for farmers on safe use and handling of pesticides, there was a high propensity that repacked pesticides were not used in their recommended dosage and for the intended purpose.

Maintaining the efficacy of pesticides

In displaying pesticides for purchase by farmers, some of the dealers (31%) as displayed in Table 9 left them in open places unprotected from direct sunlight.

According to Suglo (2002), exposing pesticides to direct sunlight changes the chemical identity of the active ingredients reducing the shelf life of pesticides and rendering them ineffective.

Delivering quality technical advice on safe use and handling of pesticides

Sale of pesticides is vital for their distribution and is carried out by pesticide dealers who also play a major role as source of information and technical advice to users of pesticides (Suglo, 2002). However, the low literacy level of pesticide dealers, as depicted in Table 6, coupled with lack of training and technical backstopping as it is evident in Table 5, and limited understanding of pesticide characteristics rendered the pesticide dealers inefficient in delivering quality technical advice on safe use and handling of pesticides.

Enforcement of pesticide regulations

Environmental Protection Agency (EPA), Plant Protection and Regulatory Services Division (PPRSD), Ghana

Standards Boards (GSB), Food and Drugs Board (FDB) and Customs, Excise and Preventive Service (CEPS) are mandated by the Pesticide Control and Management Act to enforce regulations on pesticides. These bodies institute regulatory measures for importers, distributors, sellers and users of pesticides.

Enforcement of licensing

Pesticide control and management Act 528 of 1996 requires only licensed pesticide dealers to operate. Though license acquisition is a prerequisite for pesticide marketing, quite a large proportion of the dealers (33%), as is depicted in Figure 2, operated without license.

This observation might have stemmed from the fact that the Law Enforcement Agencies failed to intensify monitoring of the activities of pesticide dealers. This observation is confirmed by the judgment of dealers on enforcement of regulations indicated in Figure 3.

Majority of the dealers (75%) confirmed that no inspectors monitored their business activities at the shops to enforce regulations on pesticide use and handling. This probably explains why pesticide dealers did not implement the precautionary measures that ensure safe use and handling of pesticides. This observation might have given room for unauthorized dealers to operate in the market contributing to adulteration of pesticides.

Compliance with measures authorized against harmful effects of pesticides

Though pesticides are useful inputs in intensive agricultural production, they are toxic chemicals that may be harmful to humans and must be handled judiciously.

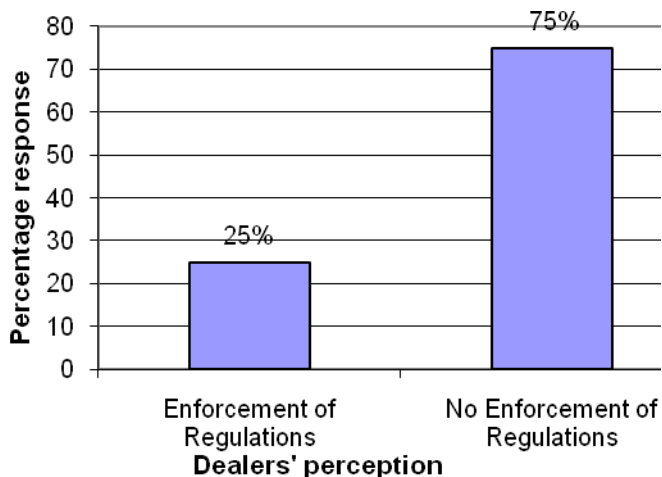


Figure 3. Dealers' judgement on enforcement of pesticide regulations.

Table 10. Precautionary measures complied by pesticide dealers.

Precautionary measures	Type of dealer						Pulled	
	Wholesaler		Retailer		Industrial distributor		Freq.	%
	Freq.	%	Freq.	%	Freq.	%		
Use of Wellington boots	0	0	0	0	0	0	0	0
Use of respirators	3	30	24	32	0	0	27	31
Use of hand gloves	5	50	38	50	0	0	43	49
Possession of fire extinguisher	1	10	0	0	2	100	3	3
Use of overall	0	0	1	1	0	0	1	1
Office separated from store	5	50	29	39	0	0	34	39
Well ventilated store	7	70	58	77	2	100	67	77

Source: Survey Data, 2010.

Table 10 shows the level of compliance with the precautionary measures authorized by the EPA to prevent pesticides from becoming harmful.

Table 10 shows that none of the dealers used Wellington boots. Only 27 representing 31% of the dealers used respirators during repackaging of pesticides. Majority of the wholesalers and all industrial distributors did not use respirators and hand gloves. Though all the retailers were found repackaging pesticides, only 24% and 38% of them used respirators and hand gloves respectively. Possession of fire extinguisher at the store to guard against fire outbreak was not a common practice, though pesticides are flammable. Few of the respondents (39%) had their offices separated from store of pesticides. The implication was that majority (61%) of them was living with vapor and fumes of pesticides which, according to Suglo (2002), were detrimental to their health. Moreover, not all of them had their stores well ventilated. Only 77% had windows

and fans in their stores to blow away vapor and fume opened pesticides. The poor attitude of pesticide dealers towards these precautionary measures does not only reduce the shelf life and efficacy of pesticides but may also have long run detrimental effects on the health of pesticide dealers and the environment. This is an indication of incompetence and lack of expertise on safe use and handling of pesticides.

CONCLUSION AND RECOMMENDATION

The hypothesis that profitability of pesticide marketing was greater than 0% was confirmed by the study. The market participants made normal profit. The second hypothesis that profitability was relatively low in remote areas was also accepted. As a result, the market could not ensure efficient distribution of pesticides to remote areas due to low profitability. Though the market was found profitable, it was not efficient in ensuring equality in

vertical and horizontal profit distribution.

Market participants had low knowledge of safe use and handling of pesticides. Their technical understanding of pesticide characteristics was limited, due to low level of education and lack of technical backstopping on safe use and handling of pesticides. Hence they were not competently equipped to technically interpret inscriptions on pesticides to illiterate farmers. They were unable to give quality technical advice to illiterate farmers. This observation is a characteristic of incompetence and poor market performance.

Though pesticide dealers repacked pesticides into smaller sizes affordable by farmers, they failed to provide requisite labels and inscriptions that provide technical information to users. Because they have limited technical understanding of pesticide characteristics, they displayed pesticides for sale in direct sunlight and that reduced shelf life and efficacy of pesticides. This phenomenon exhibits an unsatisfactory service delivery to farmers and characterises an inefficient market performance.

Despite the fact that licence acquisition is a prerequisite to entering into pesticide marketing, a part of the participants operated without licence. This is attributable to the negligence of the law enforcement agencies whose responsibility is to monitor activities of pesticide dealers. This explains why pesticide dealers did not comply with the precautionary measures that ensure safe use and handling of pesticides. Poor enforcement and compliance of regulation on safe use and handling of pesticides characterises inefficient market performance.

Since marketing of pesticides is crucial in accelerating agricultural development, the *status quo* needs to be improved by calling on the Government of Ghana and International Donor Organizations to support regular training programs on safe use, handling and repackaging of pesticides. Restricting the market to only those who can prove the minimum ability to read and understand pesticide labels and inscriptions will ensure safe use and handling of pesticides. Law enforcement agencies on safe use and handling of pesticides need to intensify monitoring to ensure proper handling of pesticides and strict adherence to precautionary measures that protect the health of pesticide dealers, farmers, consumers and the environment. In order to ensure effective distribution of pesticides to remotest areas, Cocoa Buying Companies can be encouraged to diversify their operations into pesticide marketing, since they operate widely in the remotest part of Southern Ghana.

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