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Competitiveness with Sustainable Agriculture: Win, Lose or Draw?

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ABSTRACT

Through the Polluter-Pays-Principle (PPP), it is generally assumed that the additional cost of internalization is passed on to consumers. However, stiff competition in the world market could make it difficult for exporters to pass on to international consumers, thus profit margin on export commodities is eroded and exports may be curtailed. This situation prevails in many developing countries which export a large proportion of their commodity production. When pollution control costs are substantial, voluntary implementation of environmental policy in the commodity export sector of a country may be problematic. Studies have shown mixed results that generalizations on the competitive effects of eco-friendly agriculture are unwise. Results of our study reveal that stricter environmental regulation to increase the cost of chemical inputs to encourage farmers to produce eco-friendly pepper products would enhance the export market competitiveness of both black pepper and white pepper production in Malaysia. On the other hand, to produce cocoa in a manner consistent with eco-friendly objectives requires huge sum of investment by the government. Each producer has different cost structure such that internalization of production externalities may result in higher cost of production for

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some countries but reduced cost for others. Cocoa growers in Brazil estimated an increased cost of 13.33% over variable costs at average productivity to compensate for adequate soil management, disease prevention and maintenance of production infrastructure. In Malaysia, one-third of the cost of production is accounted for the labour in combating the cocoa pod borers in estates in Sabah thus increasing the overall cost of production by 14%. However, evidence shows a reduction in the cost of production by 77% in Indonesia due to low wages in agriculture.

Keywords: Environment, Sustainable Agriculture, Competitiveness and Trade.

INTRODUCTION

Trade has served as the driving force behind much of a country's economic success. With a marked increase in interest on trade and environmental matters globally, developed as well as developing countries are aware of the imperative need to restore environmentally sound and sustainable growth, but at the same time they are concern that trade measures could be used as new forms of non-tariff barriers (NTB) to undermine the competitiveness of their export-led growth.

Environmental externalities arise both in developed and developing countries. In developed countries, internalisation of environmental externalities is to a large extent a matter of "getting the prices right", i.e. of ensuring that private and social relative prices are roughly equal. This is also important in developing countries, but here the welfare effects of policies may be as important as the relative price effects. Better integration of trade and environmental policies would provide mutual benefits and enable trade-offs to be made between competing objectives.

The basic relation between trade and the environment is straightforward. Environmental damage is associated with the production and consumption of goods. International trade alters production and consumption, thus affecting the environment. The use of policy instruments (both regulatory and economic instruments) to protect the environment can either affect international trade and act as non-tariff barriers to trade, or create opportunities for environmentally-sound products because of an increased awareness of environmental problems. Thus, trade and environment issues can be divided into two broad categories. One deals with the impacts of changes in trading rules and liberalisation on the environment and the other with the impacts of changes in environmental regulations on international trade prospects.

THE ISSUE

Measures taken to protect the environment in production involve additional costs to the producers. Can these costs be passed on to the consumers? Or be borne by the producers? When the products are traded in international markets are the international consumers willing to pay for these additional costs in terms of higher prices? Countries which ignore measures to protect their environment are competing on a different level of playing field and could offer a distorted price. Thus, competitiveness in pricing becomes a concern that many developing countries are alleged to strategically ignore environmental degradation. This paper highlights the investigation on trade effects of sustainable agriculture in two different industries, viz. pepper and cocoa and found that the effects are industry specific and cannot be generalized.

MALAYSIAN CASE STUDIES

Case #1 : Trade and Sustainable Pepper Production

Background

Pepper is grown predominantly in the state of Sarawak which accounts for 98% of the country production. Malaysia is now the sixth largest pepper producer in the world after Vietnam, India, Indonesia, Brazil and China with the annual production of about 20,000t in 2005. In terms of export, Malaysia ranks fifth with an annual export volume of 18,000t (IPC, 2006). Sarawak pepper is well-known for its consistency and reliable quality in the international market. Pepper prices have always been volatile.

Pepper cultivation is mainly carried out by the rural poor smallholders. Pepper is in fact the most important cash crop in Sarawak, providing employment to some 74,710 families in the state (DOA, 2005). Pepper farmers have involved in that cultivation for years, as such they were used to their traditional methods of cultivation which depended heavily on chemical inputs. Thus, to promote eco-friendly pepper production in Malaysia, a public policy to educate and change the mindsets of these illiterate pepper farmers is imperative. One of the feasible policy options might be to enact stricter environmental regulations through raising the costs of chemical inputs used by pepper farmers so that these pepper farmers were induced to produce only eco-friendly pepper products that comply with international environmental standards or that meet the food safety requirements set in the global arena.

Objective

The objective of this study was to evaluate the export market competitiveness of adopting eco-friendly pepper production in Malaysia.

Methodology

Simulation analysis was carried out using the modified version of Larson's (2002) methodology to examine the impact of the proposed policies to induce a reduction or even total elimination of chemical inputs use on pepper export in Malaysia so that practical policy options for the development of a viable and competitive pepper industry in Malaysia can be implemented. The sample period of 1980-2004 included periods of high pepper prices which prevailed between 1985 and 1989 and during the Asian financial crisis of 1997 –2000.

Results

Results of our simulation are presented in Tables 1 and 2. Scenarios 1, 2 and 3 reflect the increase of chemical input prices of 10 percent, 50 percent and 100 percent respectively during the periods of high and low profitability. The higher the increase in the chemical cost, the greater would be the reduction in the production and export of pepper, *ceteris paribus*. The similar price increase in chemical input was seen to have greater impact on black pepper relative to white pepper. When stricter environmental regulations were imposed by government which would cause the chemical input becomes more expensive, producers will normally react by reducing the use of the relatively more costly chemical inputs or even totally eliminate the use of these chemical inputs. This is particularly true if the input price had increased substantially and significantly. The increase in chemical cost would encourage farmers to be more judicious in utilizing their limited resources and also to be more efficient in their production process (Wong Swee Kiong, *et al*. (2007).

Interpretation

When pepper farmers were induced to produce cleaner- and safer-to-consume pepper products due to the increase in chemical cost, this would subsequently cause a higher price being fetched in the international market for the higher quality pepper produced in Malaysia. By taking into consideration the export price adjustment, the simulation results suggest that a 10% increase in the chemical cost alone would increase black pepper production by between 0.47-0.62% and black pepper export by 0.50-0.65% and it would increase white pepper production by 0.20-0.33% and white pepper export by 0.20-0.34%. After taking into account the export price adjustment, a 50% increase in the chemical cost alone, however, would increase the black pepper production by 2.37-3.11% and black pepper export by 2.48-3.25% and it would cause an increase of 0.98-1.64% and 1.01-1.68% for white pepper production and white pepper export respectively. In addition, an increase in chemical cost by 100% would induce 4.74-6.22% more black pepper to be produced and 4.96-6.50% more to be exported whereas it would induce a 1.97-3.27% additional white pepper to be produced and 2.01-3.35% additional to be exported.

Disparities in the impacts of stricter environmental regulations on pepper production and export found in white as contrasted to black pepper before the export price adjustment could be explained by the following reason: black pepper farmers are mostly very poor farmers. Whenever there is an increase in the chemical input cost, they must reduce the use of chemical input drastically in their production process, which would subsequently cause a greater reduction in the black pepper production and black pepper export as compared to white pepper production and white pepper export.

Despite that, after taking into account the export price adjustment, the impacts of stricter environmental regulations were seen to give more significant positive effects on black pepper production and exports as compared to its white pepper counterparts. This showed that a genuine improvement in black pepper quality would occur if government were to impose stricter environmental regulations since white pepper had already been considered as cleaner products relative to black pepper because of its further processing process. Thus, it was clearly seen from the simulation analysis above that imposing stricter environmental regulations by increasing the cost of chemical inputs used by pepper farmers to promote eco-friendly pepper production did not threaten the export competitiveness of our pepper industry. Indeed, it will enhance the export market competitiveness of our pepper industry in Malaysia and the effect is particularly significant in the black pepper production and export than in the white pepper production and export.

Table 1 Simulation results for Malaysian black pepper case study

	Notation	High profitability			Low Profitability		
		Scenario 1 (10%)	**Scenario 2 (50%)**	**Scenario 3 (100%)**	**Scenario 1 (10%)**	**Scenario 2 (50%)**	**Scenario 3 (100%)**
Basic Information:							
Output	Yb	Black Pepper	Black Pepper	Black Pepper	Black Pepper	Black Pepper	Black Pepper
Regulated/Affected input	X	Chemical	Chemical	Chemical	Chemical	Chemical	Chemical
Supply elasticity**	hYp	2.0771	2.0771	2.0771	2.0771	2.0771	2.0771
Input cost share	-Sx	-0.1975	-0.1975	-0.1976	-0.1975	-0.1975	-0.1975
Profitability factor	1/(1+φ)	0.7260358	0.7260358	0.7260358	0.952	0.952	0.952
Return to scale factor	hcXY	2.00	2.00	2.00	2.00	2.00	2.00
Basic Model Results:							
Cross price elasticity	hYw	-0.596	-0.596	-0.596	-0.781	-0.781	-0.781
Policy scenario: a 10% increase in chemical cost	(dw/w)x100	10.00			10.00		
Policy scenario: a 50% increase in chemical cost	(dw/w)x100		50.00			50.00	
Policy scenario: a 100% increase in chemical cost	(dw/w)x100			100.00			100.00
Percentage change in black pepper production	dY/Y	-5.957	-29.784	-59.598	-7.814	-39.069	-78.139
Export share of total production	E/Y	0.90	0.90	0.90	0.90	0.90	0.90
Percentage change in black pepper export	dE/E	-6.619	-33.093	-66.220	-8.682	-43.410	-86.821
With Export Price Adjustments:							
Domestic demand elasticity	hBp	0.091080	0.091080	0.091080	0.091080	0.091080	0.091080
Domestic consumption as share of total production	B/Y	0.10	0.10	0.10	0.10	0.10	0.10
Export demand elasticity*	hDp	0.16	0.16	0.16	0.16	0.16	0.16
Exports as a share of total production	E/Y=D/Y	0.9	0.9	0.9	0.9	0.9	0.9
Export price elasticity	hpw	0.310	0.310	0.310	0.406	0.406	0.406
Final supply elasticity with respect to input price	WYw	0.047	0.047	0.047	0.062	0.062	0.062
Final export elasticity with respect to input price	hEw	0.050	0.050	0.050	0.065	0.065	0.065
Final % change in output	dY/Y	0.474	2.370	4.743	0.622	3.109	6.218
Final % change in exports	dE/E	0.495	2.477	4.956	0.650	3.249	6.498

Notes: * This elasticity estimate is borrowed from the study done by Julie and Kanbur (1993).
** This elasticity estimate is computed from this study.

Table 2 Simulation results for Malaysian white pepper case study

	Notation	High Profitability			Low Profitability		
		Scenario 1 (10%)	**Scenario 2 (50%)**	**Scenario 3 (100%)**	**Scenario 1 (10%)**	**Scenario 2 (50%)**	**Scenario 3 (100%)**
Basic Information:							
Output	Yw	White Pepper	White Pepper	White Pepper	White Pepper	White Pepper	White Pepper
Regulated/Affected input	X	Chemical	Chemical	Chemical	Chemical	Chemical	Chemical
Supply elasticity**	hYp	2.7186	2.7187	2.7188	2.7189	2.7190	2.7191
Input cost share	-Sx	-0.1975	-0.1975	-0.1975	-0.1975	-0.1975	-0.1975
Profitability factor	1/(1+φ)	0.546	0.546	0.546	0.909	0.909	0.909
Return to scale factor	hcXY	1.10	1.10	1.10	1.10	1.10	1.10
Basic Model Results:							
Cross price elasticity	hYw	-0.322	-0.322	-0.322	-0.537	-0.537	-0.537
Policy scenario: a 10% increase in chemical cost	(dw/w)x100	10.00			10.00		
Policy scenario: a 50% increase in chemical cost	(dw/w)x100		50.00			50.00	
Policy scenario: a 100% increase in chemical cost	(dw/w)x100			100.00			100.00
Percentage change in white pepper production	dY/Y	-3.223	-16.117	-32.234	-5.370	-26.850	-53.702
Export share of total production	E/Y	0.90	0.90	0.90	0.90	0.90	0.90
Percentage change in white pepper export	dE/E	-3.581	-17.907	-35.816	-5.966	-29.833	-59.669
With Export Price Adjustments:							
Domestic demand elasticity	hBp	0.12283	0.12283	0.12283	0.12283	0.12283	0.12283
Domestic consumption as share of total production	B/Y	0.10	0.10	0.10	0.10	0.10	0.10
Export demand elasticity*	hDp	0.16	0.16	0.16	0.16	0.16	0.16
Exports as a share of total production	E/Y=D/Y	0.9	0.9	0.9	0.9	0.9	0.9
Export price elasticity	hpw	0.126	0.126	0.126	0.210	0.210	0.210
Final supply elasticity with respect to input price	WYw	0.020	0.020	0.020	0.033	0.033	0.033
Final export elasticity with respect to input price	hEw	0.020	0.020	0.020	0.034	0.034	0.034
Final % change in output	dY/Y	0.197	0.983	1.966	0.327	1.637	3.275
Final % change in exports	dE/E	0.201	1.006	2.013	0.335	1.676	3.353

Notes: * This elasticity estimate is borrowed from the study done by Julie and Kanbur (1993).
** This elasticity estimate is computed from the study.

Case #2 : Trade and Sustainable Cocoa Production

Background

Externalities in cocoa production are in general similar to many cocoa producers. Of the externalities identified, only the use of agro-chemicals such as fertilizers, insecticides, pesticides and fungicides could pose problems to the environment and are the major concern to the producers and environmentalists alike. However, they are applied at minimum levels. Farmers in Ghana, for example, do not apply fertilizers except for demonstration and research purposes. Leaves litter provide enough nutrients to cocoa trees planted under thinned forests. Farmers are taught how to control pests and diseases through biological control, minimum use of insecticides, shade and canopy manipulation. The sweatings (fruit juice) and wastes from cocoa pod husks have already found uses and studies are undertaken to determine its viability as commercial products. Each stage of cocoa production, from planting to primary processing involves environmental externalities.

Objective

The objective of the study is to evaluate the economic impact of sustainable cocoa production using the integrated pest management (IPM).

Methodology

Evaluating the economic impact of sustainable cocoa production involved two major steps. In the first step, a production function was estimated and the cost of an IPM technology quantified. Efforts to internalize environmental externalities increased the cost of production through the production function, estimated approximately at 15.6 percent (Khalid *et al*., 1995). In the second step, a market model was developed and estimated. A conservative 14 percent increase in the cost of production due to internalization was chosen for simulation (though the difference was marginal) after taking account of expert opinions that only less than 10 percent reduction in agro-chemicals was plausible given their already low level of usage and the Brazilian estimate of 13.3% increase in price to compensate for sustainable production.

Results

The structural equations of the Malaysian model are presented in Table 3. The Malaysian model was then simulated over a fifteen-year period, 1990-2005 to generate base solutions (Table 4). Simulation of the model was conducted by increasing the cost of production by 14 percent. As expected, the production of cocoa beans declined. However, the reduction in production was only marginal, i.e. 2.08 percent (Table 5). This was due to the inelastic response of the production to the cost of production. The inelastic response was quite common for perennial crops because investment in perennial crops like cocoa involved a long gestation period. Thus, once cocoa trees were planted, they became a fixed investment and as long as the market price was above the average variable cost, cocoa would be harvested. The effects on exports, domestic consumption and imports were also very marginal, at around 0.07, 0.58 and 1.14 percent, respectively (Khalid and Audrey, 2006).

Table 3 Estimated Structural equations of Malaysian cocoa

Production					
$PRCB_t$ =	36129.306	+ 4.696 PC_t	– 6.464 PC_{t-1}	– 0.679 PC_{t-2}	+ 7.998 PC_{t-3}
		(2.482)	(-3.198)	(-0.661)	(4.255)
	+ 5.513 PC_{t-4}	– 196.180 $RSS1_{t-3}$	– 1.774 $COSPC_t$	– 3.247 $COSPC_{t-1}$	– 2.003 $COSPC_{t-2}$
	(2.491)	(-4.464)	(-1.001)	(-1.988)	(-1.374)
	+ 0.786 $PRCB_{t-1}$	+ 60268.738			
	(23.032)	(9.570)			
R^2 = 0.996	h = – 0.014				
Domestic Demand					
$DDCB_t$ =	– 11193.923	– 0.559 PC_t	– 1.578 $IMPC_t$	+ 0.729 MPI_t	
		(1.265)	(2.323)	(9.272)	
R^2 = 0.858	D.W = 1.740				
Import Demand					
$IMCB_t$ =	2207.72	– 0.030 $IMPC_t$	+ 0.003 MPI_t	– 847.241 XCR_t	+ 1239.44 $DUMI_t$
		(-2.789)	(2.884)	(-4.392)	(12.868)
R^2 = 0.936	D.W = 1.883				
Domestic Price					
PC_t =	– 959.677	+ 1.126 $EXPC_t$			
		(19.164)			
R^2 = 0.973	D.W = 1.852				
Export Demand					
$EXCB_t$ =	– 70005.579	– 3.792 $EXPC_t$	+ 80.850 $WGDP_t$	+ 14501.225 XCR_t	
		(-1.312)	(16.940)	(1.408)	
R^2 = 0.975	D.W = 2.049				
Export Price					
$EXPC_t$ =	656.639	– 0.0014 STCB	+ 1.894 WPC_t	+ 0.281 $EXPC_{t-1}$	
		(-0.081)	(11.660)	(3.367)	
R^2 = 0.970	h = 0.495				

where,
$PRCB_t$ = production of cocoa beans
$DDCB_t$ = domestic demand of cocoa beans
$IMCB_t$ = import of cocoa beans
$EXCB_t$ = export of cocoa beans
PC_t = domestic price of cocoa beans
$COSPC_t$ = cost of production
$RSS1_t$ = price of rubber
$IMPC_t$ = import price of cocoa beans
MPI_t = Malaysian producer price index
XCR_t = exchange rate
$EXPC_t$ = export price of cocoa beans
$WGDP_t$ = world income
WPC_t = world price of cocoa beans
STCB = Malaysian stocks of cocoa beans

Note: Numbers in parentheses are t-values.

Table 4 Historical simulation results of Malaysian cocoa

	PRCB	EXCB	DDCB	IMCB	EXP	PC
RMSPE	0.093	0.073	0.112	0.096	0.070	0.076
U	0.050	0.052	0.066	0.052	0.030	0.031
Um	0.034	0.000	0.011	0.022	0.009	0.036
Us	0.073	0.012	0.032	0.053	0.004	0.119
Uc	0.893	0.988	0.957	0.925	0.987	0.845

Note: Um – fraction of error due to bias.
U^s – fraction of error due to different variation.
U^c – fraction of error due to different covariation.

Table 5 Average simulated values of endogenous variables with an increase in production cost

Variables	Baseline Values	Simulated Values	% Change
PRCB	154072.58	150864.58	-2.082
EXCB	112062.93	111976.79	-0.076
DCCB	39844.92	39615.22	-0.576
IMCB	496.54	490.88	-1.140

Interpretation

The reduced quantity in the Malaysian production and quantity exported was inserted in the world market model. The model was then simulated without and with reduction in the Malaysian cocoa production. The simulation results indicated that there were no changes in the world cocoa prices (Table 6). Since Malaysian export price was very much dependent on the world price, there was also no change in the Malaysian export price. Thus, if Malaysia alone were to implement the environment friendly production practices, it would incur additional cost of production without additional increase in output prices.

Table 6 Estimated structural equations of world cocoa

Production				
$WPRCB_t =$	– 324.899	+ 0.017 WPC_t	+ 0.026 WPC_{t-1}	– 0.0167 WPC_{t-2}
		(2.184)	(2.261)	(-1.166)
	– 0.001 WPC_{t-3}	+ 0.025 WPC_{t-4}	+ 0.028 WPC_{t-5}	+ 0.706 $WPRCB_{t-1}$
	(-0.116)	(2.377)	(1.166)	(2.113)
$R^2 = 0.940$	D.W = 2.029			
Demand				
$WKOC_t =$	1290.676	– 0.083 WPC_t	+ 0.328 WY_t	
		(-2.839)	(9.673)	
$R^2 = 0.949$	D.W = 1.823			

Table 6 (*Continued*)

Price					
WPC_t =	988.617	0.679 $WSTOK_t$	+ 1.115 $WKOC_t$	+ 0.630 WPC_{t-1}	+ 128.121 DUM
		(2.325)	(1.861)	(8.443)	(4.987)
R^2 = 0.869 D.W = 2.076					

where,
$WPRCB_t$ = world production of cocoa beans
$WKOC_t$ = world consumption of cocoa beans
WPC_t = world price of cocoa beans
WY_t = world income
$WSTOK_t$ = world stock of cocoa beans

Note: Number is parentheses are t - values.

POLICY IMPLICATION

Controversy exists on the effects of stricter environmental regulations on trade competitiveness. For instance, Khalid (1989) and Panayotou (2000) have highlighted that developing countries could ill afford the adverse effects of tightening environmental regulations through increases in production cost and corresponding reduction in profitability and competitiveness of the export commodities. However, Porter *et al.* (1995) had asserted that environmental regulation can induce firms to innovate cleaner technologies to reduce cost of production and thus increase competitiveness in a dynamic world. This argument is further supported by the studies done in Australia which had concluded that environmental reforms do not affect the competitiveness of agriculture sector in Australia (Randy & Anderson, 2000). Nevertheless, Jaffe *et al.* (1995) had stated that the impact of environmental regulation on trade competitiveness may differ according to structural or market characteristics of the industries concerned. Besides that, according to Khalid and Braden (1993) and Larson *et al*. (2002), no generalization can be made about the effects of environmental regulations on exports. The effects would critically depend on the magnitude of the policy change, the share of the importance of the regulated input in production cost, supply response, and demand elasticities and the possibility for efficiency improvements. Small policy changes affecting inputs that account for a small portion of overall costs of products that have relatively inelastic export demand will have minor effect on export, *vice versa*.

Generalizations on the competitive effects of eco-friendly or sustainable agriculture are unwise. Results of our study reveal that to produce cocoa in a manner consistent with eco-friendly objectives requires huge sum of investment by the government. Each producer has different cost structure such that internalization of production externalities may result in higher cost of production for some countries but reduced cost for others On the other hand, stricter environmental regulation to increase the cost of chemical inputs to encourage farmers to produce eco-friendly pepper products would enhance the export market competitiveness of both black pepper and white pepper production in Malaysia. Trade effects of environmental protection are industry-specific which can vary based on the degree of competition for each industry. Highly competitive industry could be more vulnerable since it has no market power to impose higher product prices compared to the less competitive industry.

CONCLUSION

Under the Polluter Pays Principle (PPP), producers have to pay for the emissions, for non-compliance with environmental standards and for the use of natural resources. The PPP assumes that:

- the real additional environmental costs can be passed on to consumers (User Pays Principle/Resource Pricing/Full Resource Pricing).
- conformity with PPP does not matter whether the polluter passes on to his prices some or all of the environmental costs, or absorbs them.
- competition ensures that the consumer is not charged too much, and that producers choose efficient technologies.

The basic underlying precondition is that comparable producers are confronted with identical policy so that in a closed economy, the PPP works nicely. The major problem arises when PPP is applied to international markets, i.e. when exporters have to compete with companies operating under different policy regimes. There is no unity of policy: some producers face stiffer environmental policies while others face a more lenient policy.

Generally, the capacity of a country to pass on price increase to world market depends on:

- *the country's international market share,* i.e. the higher its market share, the higher its degree of market power, the more likely it is that a country is able to effectuate a higher export supply price,
- *the share of the product export in the country's total exports,* i.e. the higher the export dependency rate, the riskier it is to take unilateral measures. The passing on capacity is inversely related to the export dependency factor,
- *the overall price elasticity of demand for the export product,* i.e. for all highly inelastic demand, price increases result in higher export earnings,
- *the structure and intensity of competition in international market,* i.e. when some countries increase their export volumes after a price increase, their supply reaction could prevent other countries from taking steps to internalise their production externalities.

Competition in the world market could make it difficult for exporters to pass on the additional costs of environmental protection to international consumers, thus profit margin on export commodities is eroded and exports may be curtailed. This situation prevails in many developing countries which export a large proportion of their commodity production. When pollution control costs are substantial, voluntary implementation of environmental policy in the commodity export sector of a country may be problematic. Our studies have shown mixed results that generalizations on the competitive effects of environmental protection cannot be convincingly made.

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