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Raw Material Sourcing and Firm Performance: Evidence from Manufacturing Firms in South-West Bangladesh

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This study considers Khulna, Jessore, Satkhira and Bagerhat districts as the south-west region of Bangladesh. The manufacturing firms of the region have diverse characteristics. This diversity arises due to variety of products, firm size, ownership pattern, technology level and raw material sources. Bakery, brick, iron & steel, coconut oil, printing press, rice milling, tiles, wood processing and wood furniture are the main manufacturing firms of the region. This study describes the raw material sourcing pattern of the manufacturing firms. The intra-region raw material sourcing is the dominating trend prevailing among the manufacturing firms of the south-west region of Bangladesh. Though the sales growth rates of such intra-region transactions are higher, the profit rates are lower than the rates for the firms dealing with outside the regions for raw material collection. The wider horizon of raw material source is positively related to the operating profit to sales ratio and negatively related to the sales growth rate. This trend indicates the necessity to expand raw material sources of the manufacturing firms for attaining higher profit—the ultimate objective of a business entity. A massive improvement in infrastructure will encourage more firms to widen their horizon of input market. This point needs to be addressed properly for improving performance of the firms located in this region.

I. INTRODUCTION

The manufacturing firms produce output and attain profit simultaneously through efficient utilisation of resources. They collect input from near by and far

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places. Such raw material sourcing helps to establish a long run relationship between suppliers and manufacturers. Some firms produce only one output, while some others are multi-product manufacturers. The firms try to use the available least cost technology for timely production and delivery of products with the given sets of resources. The success is reflected in performance.

The firms that are using various types of inputs through a sequential process for producing products are defined as manufacturing firms in this study. This study focuses on the manufacturing firms of the south-west region of Bangladesh. Bakery, brick, iron & steel, coconut oil, printing press, rice milling, tiles, wood processing and wood furniture are the main manufacturing firms operating in this region. The region is comprised with manufacturing firms of diverse characteristics. This diversity arises due to variety of products, firm size, ownership pattern, technology level and raw material sources.

Isaksen, Dreyer, and Grønhaug (2002) state that firms need adequate and timely supply of raw materials to operate effectively. Rizza (2010) states that raw material sourcing strategies are critical to revenue and profit margins of manufacturing firms. Bendiksen and Dreyer (2003) state that a move towards new sources of raw material supply influences firm performance. Some literature advocate for raw material sourcing from nearby sources, while some others advocate for far places. For example, Oyelaran-Oyeyinka (2002) states that local sourcing of raw materials induces considerable technological accumulation, though it declines capacity utilisation. In contrast, Burger (2009) finds that international sourcing of input increases product and process innovation, leading to long-run improvement of competitiveness and market position. Batthelemy and Adsit (2003), Bettis, Bradley, and Hamel (1992) and Gilley and Rasheed (2000) describe outsourcing as a powerful tool for cutting a firm's costs. Moreover, Ten Raa and Wolff (2001) argue and provide evidence that TFP growth in manufacturing industries is positively related to an increased use of outsourcing. In summary, the literature identified raw material sourcing pattern as an important element influencing firm performance.

However, there is no consensus yet in the literature about what to consider for measuring firm performance. Several researchers consider productivity for analysing performance of manufacturing firms. Entry and exit decisions of manufacturing firms, firm size, firm growth, sank cost, managerial efficiency, global association, access to utility services, red tape and security system are associated with productivity of manufacturing firms (Fariñas and Ruano 2005, Fernandes 2008, Mahadevan and Kim 2003). Technology level, R&D expenditure, ownership structure and financial strength are some other factors associated with productivity of manufacturing firms (Bin 2008, Hasan 2002, Kim 2006). Almeida, and Carneiro (2009), Bøckman, Fleten, Juliussen, Langhammer, and Revdal (2008),

and Tsang, Yip, and Toh (2008) consider investment size, technical progress and human capital formation for measuring firm performance. This study tries to understand the performance of the manufacturing firms of the south-west region of Bangladesh in light of the above literature.

An empirical study for linking firm performance and raw material sourcing pattern (from Bangladesh perspective) is hardly available in the literature. Therefore, this study places a special focus on establishing a relationship between firm performance and raw material sourcing pattern.

II. DATA AND METHODOLOGY

This study considers five measures to address performance of manufacturing firms: (i) average sales growth, (ii) average employment growth, (iii) capacity utilisation rate, (iv) target fulfillment rate, and (v) operating profit to sales ratio. It defines "sales growth" as the percentile growth in sales (value) of a firm in two successive years, and "average sales growth" as the average of the growths. Similarly, "employment growth" is the percentile growth in total employment of a firm in two successive years, and "average employment growth" is the average of the growths. The "capacity utilization rate" is the ratio between "utilized capacity" and "installed capacity," "target fulfillment rate" is the ratio between "targeted production" and "actual production," and "operating profit to sales ratio" is the ratio between operating profit and sales of the firms in a year.

In measuring average sales growth, the firms established in the year 2008 are not considered due to unavailability of sales growth data. The one-year sales growth (2007-2008) for the firms those were established in 2007, two-year sales growth (2006-2008) for the firms those were established in 2006 and three-year sales growth (2005-2008) for the firms those were established in 2005 or earlier are considered in this study. The same concept is applied for average employment growth measurement. The capacity utilisation rate, target fulfillment rate and operating profit to sales ratio are pertinent to the year 2008.

Finding out the relationship between raw material sourcing pattern and firm performance is the main objective of this study. Therefore, it attempts to test the following general hypothesis:

H0: Raw material sourcing pattern has no impact on firm performance.

It considers three approaches for capturing raw material sourcing pattern of manufacturing firms. The distance between supplier and producer, the regional classification based on location of giant rivers and intra vs. inter region suppliers are the three dimensions of this study. The distance between supplier and producer is measured in kilometer (km). The regional classification based on location of giant

rivers of Bangladesh finds four major groups: (i) South and West part of Padma and Meghna rivers defined as "S-W" region, (ii) North and West part of Padma and Jamuna rivers defined as "N-W" region, (iii) Domestic others covering the regions not included in "S-W" and "N-W" regions, and (iv) Abroad. This study also considers the four districts, namely Khulna, Jessore, Satkhira and Bagerhat, to represent south-west region of Bangladesh. The sourcing of raw materials from the said four districts is defined as an intra-region sourcing. The sourcing from other regions is defined as an inter-region sourcing of raw materials.

Therefore, the specific hypotheses are:

H0a: Distance from raw material supplier has no impact on firm performance.

H0b: Raw material sourcing from various regions has no impact on firm performance.

H0c: Sourcing from intra/inter-region suppliers has no impact on performance.

Yearly sales and operating profit of the year 2008 are considered as dependent measures for running simple linear regressions with variables representing raw material sourcing pattern as explanatory measures. Equation 1 represents the general form of the simple linear regression equation. Moreover, a multiple regression analysis is done to reconfirm the findings. The highly correlated variables are excluded in running multiple regressions (Equation 2).

$$Y_i = \beta_{0ij} + \beta_{1ij}X_j + u_{ij} \quad (1)$$

$$Y_i = \beta_{0ij} + \sum\beta_{1ij}X_j + u_{ij} \quad (2)$$

where, *i* stands for dependent measures and *j* stands for explanatory measures.

All types of manufacturing units operating in the south-west region of Bangladesh are covered in this study. The study has used both secondary and primary data. It considers database of Bangladesh Bureau of Statistics (BBS), local business forums and groups such as Khulna City Corporation (KCC), Khulna Chamber of Commerce and Industries (KCCI), Khulna Development Authority (KDA), Tax office and product-wise exporter's associations to identify population of manufacturing firms operating in the south-west region of Bangladesh. A stratified random sampling technique is used in selecting sample manufacturing firms. Product is the main stratum of this study. Under sampling/over sampling is done in some cases to make the product groups representative. The sample size of

the study is 335. A formal questionnaire is used to collect primary data from the sample firms.

III. EMPIRICAL FINDINGS

Raw material collection from nearby sources is the dominant trend for the manufacturing firms of the south-west region of Bangladesh. About half of the firms' main raw material suppliers are located within five kilometers from the factory premises (Table I). Only 16 per cent firms collect their main raw material from more than 100 kilometers distance.

About 66 per cent firms collect 76-100 per cent of their main raw materials from the S-W region and another 24 per cent firms collect a part of their main raw materials from the said region. However, 10 per cent firms completely depend on outside the region for main raw materials. Only 15 per cent firms either partly or fully depend on N-W region (i.e. the Rajshahi Division) for getting their main raw materials. About 33 per cent firms depend on the other regions of the country to collect main raw materials partly or fully. However, only few firms (6 per cent) cross the country boundary for collecting main raw materials either partly or fully (Table II).

TABLE I
DISTANCE BETWEEN MAIN RAW MATERIAL SOURCE AND FACTORY PREMISE

Distance (in km)	Number of Firms
1 km	45 (15)
2 - 5 km	124 (37)
6 - 50 km	88 (26)
51 - 100 km	26 (08)
More than 100 km	52 (16)
All	335 (100)

Source: Field Survey (2008-09).
Note: The numbers in the parentheses indicate percentages.

Raw material source is a key factor for the performances of manufacturing firms. A lower average employment growth and lower target fulfillment rate characterise the 100 per cent local raw material user manufacturing firms. However, these 100 per cent local raw material user manufacturing firms average sales growth is higher compared to the firms that use raw materials from outside of the region.

TABLE II
SHARE OF MAIN RAW MATERIAL SOURCED FROM VARIOUS REGIONS

Share	Number of Firms			
	S-W	N-W	Others	Abroad
0 %	35 (10)	287 (85)	226 (67)	316 (94)
1 - 25 %	12 (04)	27 (08)	22 (07)	10 (03)
26 - 50 %	39 (12)	16 (05)	43 (13)	4 (01)
51 - 75 %	28 (08)	3 (01)	16 (05)	3 (01)
76 - 100 %	221 (66)	2 (01)	28 (08)	2 (01)
Total	335 (100)	335 (100)	335 (100)	335 (100)

Source: Field Survey (2008-09).

Note: The numbers in the parentheses indicate percentages.
"S-W" stands for "South and West part of Padma and Meghna rivers," "N-W" for "North and West part of Padma and Jamuna rivers – the Rajshahi Division," "Others" for "All other regions of Bangladesh not included in S-W and N-W."

The survey findings indicate that a wider horizon of raw material source is positively related to operating profit to sales ratio and negatively related to sales growth rate. The wider the horizon of raw material source (from distance perspective), the lower the sales growth, and the higher the operating profit to sales ratio with some exceptions. This trend indicates a necessity to expand raw material sources of the manufacturing firms for attaining higher profit—the ultimate objective of a business entity.

The number of raw material supplier signals about the competition in the input market. The field level data finds that more than one-third of the firms depend on 1-5 suppliers for their main raw materials, whereas more than 10 per cent firms depend on more than 20 suppliers (Table III). The scenario demonstrates the existence of competition in the input market.

TABLE III
NUMBER OF MAIN RAW MATERIAL SUPPLIERS

Number of Suppliers	Number of Firms
1 - 5	129 (39)
6 - 10	103 (31)
11 - 20	65 (19)
More than 20	38 (11)
Total	335 (100)

Source: Field Survey (2008-09).
Note: The numbers in the parentheses indicate percentages.

This study finds statistically significant and strong positive correlation among sales, operating profit, firm size and technology level of the manufacturing firms (Table IV). The strong positive correlations among sales, operating profit, firm size and technology level signals that all these indicators move in the same direction for a push from supply/demand side. Therefore, it makes the room for raw material sourcing pattern to work as the push factor. A positive change in any of the said indicators for a push from raw material sourcing pattern will create multiplier impact on firm performance.

TABLE IV
CORRELATION COEFFICIENTS

		Sales	Operating Profit	Firm Size (Employment)
Operating Profit	Pearson Correlation	.987	1	
	Sig. (2-tailed)	.000	.	
	N	271	271	
Firm Size (Employment)	Pearson Correlation	.571	.511	1
	Sig. (2-tailed)	.000	.000	.
	N	287	271	335
Technology Level	Pearson Correlation	.724	.669	.440
	Sig. (2-tailed)	.000	.000	.000
	N	225	210	258

Source: Field Survey (2008-09).

Table V lists the regression analysis results between raw material sourcing pattern and firm performance. In the simple regression analysis, the distance from main raw material supplier is a significant predictor of firm performance. Similarly, considering the regional classification based on location of giant rivers, regression analysis finds a statistically significant negative relationship between raw material sourcing from S-W region and firm performance, and a significant positive relationship between raw material sourcing from N-W/other regions and firm performance. There is also a significant negative relationship between firm performance and intra-region raw material sourcing.

TABLE V
REGRESSION RESULTS BETWEEN RAW MATERIAL SOURCING PATTERN AND FIRM PERFORMANCE

	Dependent Measures (Y)			
	Sales (BDT) [N=286]		Operating Profit (BDT) [N=270]	
Simple Regression Analysis				
Factors Influencing Firm Performance (X)	Standardized Coefficient (β1)	P-value	Standardized Coefficient (β1)	P-value
Distance from Main Raw Material Supplier (Km.)	0.276	0.000	0.265	0.000
Share of Main Raw Material Sourced from S-W Region (%)	–0.252	0.000	–0.262	0.000
Share of Main Raw Material Sourced from N-W Region (%)	0.213	0.000	0.192	0.001
Share of Main Raw Material Sourced from Other Regions of Bangladesh (%)	0.188	0.001	0.197	0.001
Share of Main Raw Material Sourced from Abroad (%)	0.053	0.368	0.091	0.136
Share of Main Raw Material Sourced from Intra-Region (%)	–0.364	0.000	–0.360	0.000
Multiple Regression Analysis*				
Share of Main Raw Material Sourced from S-W Region (%)	-0.209	0.002	-0.216	0.002
Share of Main Raw Material Sourced from N-W Region (%)	0.139	0.025	0.117	0.067
Share of Main Raw Material Sourced from Abroad (%)	-0.016	0.793	0.014	0.828

Source: Field Survey (2008-09).

*N.B.: *To avoid multicollinearity problem, two factors (Share of Main Raw Material Sourced from Other Regions of Bangladesh and Share of Main Raw Material Sourced from Intra-Region) are dropped in the multiple regression analysis.*

To reconfirm the significances of the raw material sourcing pattern on firm performance, a multiple regression analysis is also performed. Among the various raw material sourcing related explanatory measures, the raw material sourcing from other regions of Bangladesh and raw material sourcing from intra-region are highly correlated (Pearson Corr. > 0.70) and hence both measures are dropped from the model. The remaining raw material sourcing measures are not highly correlated (Pearson Corr. < 0.30). Table V lists the findings of the multiple regression analysis. The findings are consistent with the findings obtained from multiple regression analysis. In summary, all the three approaches (i. distance between

supplier and producer, ii. the regional classification based on location of giant rivers and iii. intra- vs. inter-region suppliers) advocate for widening of raw material sources for attaining higher performances.

IV. CONCLUSIONS AND POLICY IMPLICATIONS

This study describes the raw material sourcing pattern of the manufacturing firms. The firms of the south-west region of Bangladesh have diverse characteristics. This diversity arises due to variety of products, firm size, ownership pattern, technology level and raw material sources. The main manufacturing firms covered by this study are bakery, brick, iron & steel, coconut oil, printing press, rice milling, tiles, wood processing and wood furniture. The surveyed manufacturing firms are located in four districts: Khulna, Jessore, Satkhira and Bagerhat.

The wider horizon of raw material source is positively related to the operating profit to sales ratio and negatively related with the sales growth rate of the manufacturing firms in the south-west region of Bangladesh. This trend indicates the necessity to expand raw material sources of the manufacturing firms for attaining higher profit—the ultimate objective of a business entity.

This study finds that crossing the regional boundary for raw material collection positively and significantly influences the performance of manufacturing firms. Proper dissemination of this message among the business community is a prime task. Transportation cost, road condition, required time, existence of bridge on river and condition of ferry largely influence raw material sourcing decision of manufacturing firms. Therefore, step toward physical infrastructure development for smoothening raw material sourcing is the main policy implication of this study.

The intra-region raw material sourcing is the dominating trend prevailing among the manufacturing firms of the south-west region of Bangladesh. Though the sales growth rates of such intra-region transactions are satisfactory, the profit rates are lower than the rates for the firms dealing with outside the regions for raw material collection. A massive improvement in infrastructure will encourage more firms to widen their horizon of input market. This point needs to be addressed properly for improving performance of the manufacturing firms located in the region.

This study considers only the raw material sourcing pattern of manufacturing firms and tries to relate it with firm performance. However, production and distribution are two other important channels that significantly influence the firm performance. An integrated approach considering all the three channels (sourcing, production and distribution) simultaneously will provide better results.

This study considers sales, profit, expansion, target fulfillment and capacity utilisation as main performance measuring indicators. However, there is no consensus yet in the literature about selecting performance measuring indicators. The selection of performance measures depends on study objective, location, product and time. Therefore, a careful considering of the considered performance measures is needed.

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