



COMPARATIVE ANALYSIS OF NET INCOMES FOR SUPPLY CHAIN ACTORS OF FRESH TOMATO IN BAUCHI STATE, NIGERIA

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ABSTRACT

The study compared the net farm income of fresh tomato supply chain actors (SCAs) among central, western and northern zones of Bauchi State. Primary data were collected with the use of a structured questionnaire. Simple random sampling technique was used to select 658 supply chain actors (producers, wholesalers, and retailers). The data collected were analysed using farm budgeting technique and analysis of variance (ANOVA). The result reveals net incomes of ₦186025.35, ₦321883.48 and ₦ 66858.45 for producers, wholesalers and retailers, respectively. Also, the study shows returns per naira invested on every one naira as ₦0.78, ₦0.29 and ₦0.2, minimum net incomes of ₦ -314058.33, ₦ -2499400, ₦-80250.00 and maximum net incomes of ₦979826.67, ₦ 4929150.00, ₦ 368050.0 for producers, wholesalers and retailers, respectively. The result shows significant differences in the net incomes of wholesalers and produce; wholesalers and retailers; and between retailers and producers at $p < 0.05$ and $P < 0.01$ was observed. The result further reveals minimum costs incurred as ₦115122.50, ₦253450.00, ₦73470.00 and maximum costs incurred as ₦ 805658.33, ₦4026350.00 and ₦ 725570.00 for the SCAs. The result indicated significant differences in costs incurred between wholesalers and producers, wholesalers and retailers at $P < 0.01$. The study concluded that fresh tomato production and marketing in the study area was profitable among the supply chain actors. It can also be said that there was significant differences in both the net incomes obtained and costs incurred by the supply chain actors among the zones. The study recommends that decisions on fresh tomato production and marketing be adjusted and re-established so as to optimise their profits. Also, SCAs can sell their products online by registering their product and location. This will allow easy access of the product by customers and it will help broaden fresh tomato market, which in turn will increase the income of the supply chain actors in the study area.

Keywords: Actors, Chain, Marketing, Production, Profits, Supply, Tomato.

INTRODUCTION

Agriculture is the main source of income for many developing countries and will continue to form part of their gross domestic product (GDP) (World Bank, 2011; and Abdullahi *et al.*, 2015). In Nigeria, agriculture is the main source of food and raw material for the nation's economy and also provides job opportunities to many of its citizens both directly and indirectly.



The sector also has great exports earning potentials that could greatly assist in the expansion of foreign exchange earnings of the country. Abbott and Makeham (1990); Emmanuel and Eminu (2015) are of the opinion that regardless of the level of development of any country, agriculture still plays an important role in the socio-economic lives of the people. In Nigeria during the 1960s, comparing agricultural sector with other sectors of the economy, had played a very vital roles of providing the bulk of the nation's food, revenues and employment for individual farmers at Local, State and Federal Governments. About 75% of the Nigerian population was employed by the sector (Mamman *et al.*, 2015) and it contributed about 40% of the GDP (Akpan, 2012). Till today, agriculture still remains the main stream of the Nigerian's economy. The production and marketing of tomato serve as source of employment and food to producing and marketing families as well as to its consumers (Oladapo *et al.* (2011). Tomato Vegetables are therefore of great value to human development (Kalidas *et al.*, 2014). Fruits and vegetables constitute about 25% of the major food crops cultivated in the country (Shuaibu and Mohammed, 2015).

Although several studies have been carried out on tomato product, most of these studies were mainly on the production and economic analysis of individual supply chain members. But, little or no attention was given to the supply chain as a whole in Bauchi State. Hence the need to study the supply chain actors (producers, wholesalers and retailers) for tomato in Bauchi State. This is because the findings of this study might provide solutions that could be very useful to the supply chain members in the state. Also, the findings of this study would provide information that will be useful to business organisations, tomato producers, and marketers outside the state. More so, policy makers would use the information to adjust and or formulate old and new policies. The aim of the study was to examine the supply chain of fresh tomato in Bauchi State. The specific objectives were to:

- i. determine the profitability of fresh tomato producers, wholesalers and retailers;
- ii. compare the net incomes of the supply chain actors among the three zone; and
- iii. compare the costs incurred by the supply chain actors among the three zone.

MATERIALS AND METHODS

The Study Area

Bauchi State is the study area. It is one of the thirty six (6) States of Nigeria and was created in 1976. The State is boarded by Taraba and Plateau State to the south, Gombe and Yobe to the East, Kano and Jigawa to the North and Kaduna in the west (BSG, 2011) Bauchi State is divided into three agricultural zones namely: Northern, Central and Western zones. The State is made up of twenty local government areas which are Bauchi, Kirfi, Alkaleri, Toro, Dass, Tafawa-Balewa, and Bogoro in the Western Zone; Zaki, Itas-Gadau, Gamawa, Jama'are, Katagum, Dambam, Giade, Shira and Misau in the Northern zone, and Darazo, Warji, Ningi and Ganjuwa are in the central zone. Bauchi State is located in the Northern Guinea Savannah Ecological zone of Nigeria. It lies between latitude 9° 3' and 12° 3' North of the equator and longitudes 8° 50' and 11° East of the Greenwich Meridian. Bauchi State occupies a total land area of 49,119km² representing about 15% of the Nigerian's total land mass (BSADP, 2015).



The State has an estimated population of 4,889,811.2 (National Bureau of Statistics [NBS], 2016). Majority of the inhabitants are Geremawa, Hausa Fulani, Sayawa, Jarawa and others. Most (80%) of the farmers of Bauhi State are predominantly subsistence farmers. The farmers in the state practice both dry and rainy seasons farming. They produce vegetables such as tomato, pepper, okra, lettuce, cabbage, amaranth among others. Other major crops produced include rice, maize, millet, cowpea, *acha*, groundnut, sesame and guinea corn. They also keep livestock such as goats, sheep, cattle, and poultry too.

The temperature range is 9.11°C minimum and 40.55°C maximum (BSADP, 2015). Bauhi State is characterized by a dust atmosphere referred to as harmattan with visibility being low as 100m. Secondly, is the southwest Maritime air mass. This wind system is responsible for the rainy season experienced in the state. The mean annual rain fall ranges from 700mm in extreme north (Zaki) and 1300mm in the southern part (Toro) of the state. The state is characterized by two distinct seasons (the rainy and dry seasons). The rainy season begins from May and ends October and the dry season starts November and ends in April.

Sampling Techniques

The target population for the study was the fresh tomato small scale producers, wholesalers and retailers. A preliminary survey was conducted in order to identify the major tomato producing areas in each zone. Both purposive and random sampling techniques were used. First, a purposive sampling technique was used to select three (3) local government areas (LGAs) from each zone and two (2) villages from each of the selected LGAs. This gave the total number of nine (9) LGAs and 18 villages. The purposive selection of all the LGAs and villages was based on the intensity of tomato production in the study area. These LGAs and their villages in bracket were as follows: Northern zone; Jama'are (Dogon-Jeji and Gongo); Zaki (Sakwa and Ariri); Misau (Zindi and Misau); Central zone: Warji (Badeyaso and Wando); Ningi (Kafin Zaki and Tsangaya), Ganjuwa (Filin-Shagari and Marbini); and in the Western zone; Toro (Tilde and Ganye); Kirfi (Badara and Baba) and Dass (Dabandak and Wandu).

Two (2) markets were selected from each zone. These markets were Jama'are and Misau in the northern zone; Cheledi and Toro in the Western zone while Ningi and Soro were from Central zone. In addition, Muda-Lawal market was also chosen being a collection centre for fresh tomato in Bauhi State. A list of both small scale tomato farmers (1,524) and retailers (1,278) were obtained and used as the sample frame.

A simple random sampling technique was used to ensure that each member of the target population was given equal chance of being selected. Thus, 20% of both farmers and retailers from the selected areas were chosen. This gave the total number of 301 farmers and 252 retailers from the sampling frame of 1,524 and 1,278, respectively. In all, 105 wholesalers in the three (3) zones were used for the study. This was because their population was considered not very large. In all, 658 respondents were randomly selected and interviewed for the study.

Method of Data Collection

Primary data from a field survey were collected with the use of structured questionnaire. Information pertaining costs and returns were collected. Data were analysed using the following tools: farm budget technique and analysis of variance.



Analytical Techniques

Net farm income analysis was used to determine the profitability of fresh tomato producers and marketers. This was aimed at achieving objective one and three of the study. Mathematically; net farm income model as used by Sanni *et al.* (2003) and Mshelia (2011) can be specified as follows:

$$NFI = \sum Q_y P_y - \sum X_j P_x - \sum F_k \quad \dots(1)$$

where;

NFI = Net Farm Income (₦)

Q_y = Quantity of tomato (kg/Ha)

P_y = Unit Price of Fresh tomato (₦)

$Q_y P_y$ = Total Revenue from fresh tomatoes (₦)

X_j = Quantity of J^{th} variable input per unit (₦)

P_x = Price per unit of j^{th} variable input used (₦)

$X_j P_x$ = Total cost of variable input used (₦)

F_k = Value cost of fixed input used (₦)

\sum = Summation symbol

For tomato wholesaler and retailers the functions is specified as follows:

$$NMI = \sum Q_y P_y - \sum X_j P_x - \sum F_k \quad \dots(2)$$

where;

NMI = Net market income (₦)

Q_y = Quantity of tomato purchase (kg/Ha)

P_y = Unit Price of Fresh tomato (₦)

$Q_y P_y$ = Total revenue from sales of fresh tomatoes (₦)

X_j = Quantity of variable input per unit (₦)

P_x = Price per unit of variable input used (₦)

$X_j P_x$ = Total cost of variable inputs (₦)

F_k = Value cost of fixed input (₦)

\sum = Summation symbol

With regards to measures of financial position, in order to determine the capital and financial position of the producers and marketers, certain ratios were used. These ratios were gross ratio (GR), operating ratio (OR), and fixed ratio (FR). The ratios were calculated as follows:

$$GR = \frac{TC}{TR} \quad \dots(3)$$

$$OR = \frac{TVC}{TR} \quad \dots(4)$$

$$FR = \frac{TFC}{TR} \quad \dots(5)$$

where;

GR = Gross Ratio

OR = Operational Ratio



FR = Fixed Ratio

TC = Total Cost (₦)

TR = Total Revenue (₦)

TVC = Total Variable Cost (₦)

TFC = Total Fixed Cost (₦)

Analysis of variance (ANOVA) was used to achieve objective two. ANOVA involves the test of significant difference among three or more sample means or the test of null hypothesis that the sample means are all equal (Eboh, 2009). Thus, it was used to test the hypothesis that net incomes made on fresh tomato across zones were not the same. This is to prove whether the statement made above is true or not. Whether there is significant difference between net incomes obtained by the supply chain actors or not.

RESULTS AND DISCUSSION

Costs and Returns for fresh Tomato Supply Chain Actors by Zones in Bauchi State

To compare the performance of producers, wholesalers and retailers in the study area, costs and returns were computed in order to determine the net income of the supply chain actors. The result (Table 1) shows that total variable costs incurred by producers, wholesalers and retailers, respectively, were ₦218571.84, ₦1100130.33 and ₦236957.76. Total fixed costs incurred were ₦19543.55, ₦977.14 and ₦882.38 for producers wholesalers and retailers, respectively. The total revenue obtained by producers was ₦424140.73, for wholesalers it was ₦1422990.95 and for retailers, it was ₦304708.59. The result further reveals the net income for producers as ₦186025.35; for wholesalers as ₦321883.48 and for retailers as ₦66868.45. For every one naira invested by producers, wholesalers and retailers, ₦0.78, ₦0.29 and ₦0.28 respectively, were realised. The implication of this is that profitability of a wholesaler of fresh, tomato in Bauchi state was higher than the profitability of a producer (farmer) which is also higher than the profitability of a retailer. This also shows that Wholesalers made more profit than producers and retailers. Nevertheless, tomato production and marketing in Bauchi State was profitable among the supply chain actors. This finding is consistent with Haruna *et al.* (2012); Bosede (2014); and Ibitoye *et al.* (2015) that tomato production and marketing is actually profitable in Northern Nigeria.



Table 1: Costs and Returns for Fresh Tomato Supply Chain Actors in Bauchi State

| Parameter | Producers ₦/ha (%) | Parameter | Wholesalers ₦/month (%) | Retailers ₦/month (%) |
|-------------------------|-----------------------|---------------------------|-------------------------------------|------------------------------------|
| a. Variable cost | | a. Variable cost | | |
| Seed Cost | 1358.89 (0.57) | Acquisition Cost | 1017828.57 (92.44) | 228759.25(96.18) |
| Fertilizer Cost | 35480.48 (14.90) | Labour Cost | 42669.43 (3.88) | 674.68 (0.007) |
| Agro-Chemical Cost | 8337.24 (3.50) | Transportation Cost | 13001.67 (1.18) | 3044.17 (1.28) |
| Fuel Cost | 2784.29 (1.77) | Tax/Levy | 113.05 (0.01) | 964.68 (0.41) |
| Labour Cost | 124244.58 (52.18) | Value of lost tomatoes | 26517.62(2.41) 1100130.33(99.91) | 3514.98 (1.48) 236957.76(99.63) |
| Transportation | 46366.35 (19.47) | Total Variable cost | | |
| Total Variable Cost | 218571.84(91.79) | b. Fixed Cost | 977.14 (0.09) | 882.38 (0.37) |
| b. Fixed Cost | | Rent Cost | 977.14(0.09) | 882.38 (0.37) |
| Depreciation On: | | Total Fixed cost | 1101107.48 | 237840.14 |
| Water Pump | 15421.93 (6.48) | Total Cost | | |
| Hoes | 560.66 (0.24) | c. Revenue | 1394030.95 | 297141.62 |
| Axe | 293.79 (0.12) | Sales of Tomatoes | 19371.90 | 2015.79 |
| Knapsack | 3034.22 (1.27) | Sales of old Basket | 9588.09 | 5551.17 |
| Cutlass | 232.95 (0.19) | Consumed value | 1422990.95 | 304708.59 |
| Total Fixed Cost | 19543.55 (8.20) | Total revenue | 322860.62 | 67750.83 |
| Total Cost | 238115.38 | Gross Margin | 321883.48 | 66868.45 |
| c. Revenue | | Net Income | 0.29 | 0.28 |
| Sales of Tomatoes | 381994.22 | Return on invested | 0.77 | 0.77 |
| Consumed value | 42146.51 | Operating ratio | 0.0006 | 0.003 |
| Total Revenue | 424140.73 | Fixed ratio | 0.77 | 0.78 |
| Gross Margin | 205568.89 | Gross ratio | | |
| Net Income | 186025.35 | | | |
| Return on invested | 0.78 | | | |
| Operating ratio | 0.52 | | | |
| Fixed ratio | 0.05 | | | |
| Gross ratio | 0.56 | | | |

Source: Field survey (2017)

Average net incomes (₦) of fresh tomato supply chain actors by zones.

Table 2 presents the mean net income obtained by the supply chain actors (SCAs) in Central, Western and Northern zones. Central zone producers had mean net income of ₦171581.48 Western and Northern zone Producers had mean net incomes ₦213107.45 and ₦140727.06, respectively. The mean net incomes obtained by Central zone, Western zone and Northern zone Wholesalers were ₦282851.92, ₦575781.56 and ₦339253.30. For Retailers, the average net incomes were ₦71265.70, ₦80013.33 and ₦40081.00 for Central, Western and Northern zones respectively. Also, producers, wholesalers and retailers in Bauchi state had average net incomes of ₦186025.35, ₦321883.48 and ₦66868.45, respectively. Table 2 also presents the minimum and maximum net incomes received by the SCA per naira per hectare as in the case of producers. And for wholesalers and retailers, it was per naira per month. In the case of producers of Central, Western and Northern zones received minimum net incomes of ₦-243258.33, ₦-89916.67, ₦-346090.00 and maximum net incomes of ₦714672.50, ₦885926.67 and ₦607621.67, respectively. Wholesalers in Central, Western and Northern



zones received minimum net incomes of ₦-169250.00, ₦-671100.00 ₦-2239700 and maximum net income of ₦1280850.00, ₦5159700.00 ₦3382450.00, respectively. Retailers of Central Western and Northern zones received minimum net incomes of ₦-76600.0 ₦-80250.00 ₦-40170.00 and maximum net incomes of ₦265500.00 ₦368050.00 ₦207750.00, respectively. The negative sign on the minimum net incomes implies that some of the supply chain actors made loss instead of profit.

Table 2: Average Net Incomes of Fresh Tomato Supply Chain Actors in Bauchi State

| Actors | Zones | N | Mean | Std. Dev. | Min. | Max. |
|----------------------|---------------|-----|-----------|-----------|------------|------------|
| Producers (₦/ha) | Central Zone | 66 | 171581.48 | 176491.86 | -243258.33 | 714672.50 |
| | Western Zone | 110 | 213107.45 | 174873.83 | -89916.67 | 885926.67 |
| | Northern Zone | 125 | 140727.06 | 174499.57 | -346090.00 | 607621.67 |
| Wholesaler (₦/month) | Central Zone | 26 | 282851.92 | 36496.07 | -169250.00 | 1280850.00 |
| | Western Zone | 37 | 575781.56 | 954052.56 | -671100.00 | 5159700.00 |
| | Northern Zone | 47 | 339253.30 | 964102.41 | -2239700 | 3382450.00 |
| Retailers (₦/month) | Central Zone | 50 | 71265.70 | 79976.41 | -76600.00 | 265500.00 |
| | Western Zone | 13 | 80013.33 | 85684.18 | -80250.00 | 368050.00 |
| | Northern Zone | 72 | 40081.00 | 46196.30 | -40170.00 | 207750.00 |
| Actors | | | | | | |
| State | Producers | 300 | 186025.35 | 181085.18 | -314058.33 | 979826.67 |
| | Wholesaler | 105 | 321883.48 | 834717.28 | -2499400. | 4929150.00 |
| | Retailer | 252 | 66868.45 | 76972.56 | -80250.00 | 368050.00 |

Source: Field survey (2017)

Net Income Differentials of Fresh Tomato Supply Actors by Zones

The result (Table 3) shows the extent to which the net incomes obtained among supply chain actors in the three zones (Central, Western, Northern zones) of Bauchi state varied significantly from one another. To achieve this, one way ANOVA was used in testing these differences. Comparing among producers of fresh tomato between the three zones, the result in Table 3 indicates that there was no significant difference in the income obtained between Western and Central zones, but there was significant difference between Western and Northern zones at $P < 0.05$. The implication is that producers of Western and Central zones obtained similar net incomes and Western zone obtained higher net income than Northern zone. There was no significant difference between Northern and Central zones. This implies that the two zones obtained similar net incomes.



Table 3: Net Income Differentials of Fresh Tomato Supply Chain Actors between Zones

| Actors | Zone (i) Zone (j) | Mean Difference (i-j) | Std. error | Sig. | 95% confidence interval | |
|----------------------|----------------------------|-----------------------|------------|------|-------------------------|-------------|
| | | | | | Lower Bound | Upper Bound |
| Producers (₦/ha) | WZ /CZ | 41525.98 | 27258.78 | .339 | -23928.73 | 106980.69 |
| | WZ/NZ | 72380.39 | 22887.64 | .005 | 17421.82 | 127338.97 |
| | NZ/C Z | -30854.41 | 26638.40 | .574 | -94819.44 | 33110.61 |
| Wholesaler (₦/month) | WZ /CZ | 292929.64 | 225349.51 | .481 | -254123.66 | 839982.94 |
| | WZ/NZ | 236528.27 | 195611.29 | .542 | -238333.21 | 711389.74 |
| | NZ/C Z | 56401.38 | 208607.59 | .990 | -450009.63 | 562812.38 |
| Retailers (₦/month) | WZ /CZ | 8747.63 | 12531.44 | .864 | -21376.78 | 38872.05 |
| | WZ/NZ | 39932.33 | 11062.65 | .001 | 13338.71 | 66525.91 |
| | NZ/CZ | -31184.70 | 13862.77 | .074 | -64509.51 | 2140.11 |
| State | Actor (i) Actor (j) | | | | | |
| | Wholesaler/producer | 135858.13 | 40537.10 | .003 | 38817.97 | 232898.28 |
| | Wholesaler/retailer | 255015.04 | 41543.86 | .000 | 155564.85 | 354465.19 |
| | Retailer/producer | -119156.89 | 30538.43 | .000 | -192261.62 | -46052.18 |

Note: WZ = Western Zone; CZ = Central Zone; NZ = Northern Zone

Source: Field survey (2017)

Also in Table 3, comparing among wholesalers between Central, Western and Northern zones, the result indicates no significant difference between the three (3) zones. This shows that net income obtained by wholesalers in the three zones in Bauchi State were similar. As for retailers, the result indicated significant difference between Western and Northern zones, at $P < 0.01$. The implication is that Western zone retailers obtained higher net income than Northern zone retailers while Western and Central zones, Northern and Central zones retailers obtained similar net incomes. The implication is that, there was no significant difference in the net incomes obtained between Western and Central, Northern and Central zones retailers. Table 3 also presents the mean net income difference among the supply chain actors. From the result, there was significant difference between wholesalers and producers, wholesalers and retailers and between retailers and producers at $P < 0.05$ and $P < 0.01$. This implies that wholesalers obtained higher net income than producers and retailers in Bauchi State.

Average Total Cost (₦) of Fresh Tomato Supply Chain Actors by Zones

Table 4 presents the mean total cost incurred by the supply chain actors in the three zones (Central, Western and Northern) in Bauchi state. Central zone, Western zone and Northern zone producers incurred mean total cost of ₦206663.98, ₦261635.82 and ₦261644.14, respectively. The implication is that Northern zone producers incurred higher mean total cost than producers of Central and Western zones and Western zone than Central zone. Indicating that Central zone incurred the least total cost as compared to Western and Northern zones. Also, mean total cost of ₦791151.92, ₦870218.44 and ₦1431681.81 were incurred by Central zone, Western zone and Northern zone wholesalers, respectively. This shows that Northern zone wholesalers incurred higher mean total cost than Central and Western zones. And Western zone wholesalers incurred high cost than Central zone.



Table 4: Average Total Cost of Fresh Tomato Supply Chain Actors between Zones

| Actors | Zones | N | Mean | Std. Dev. | Min. | Max. |
|-------------------------|---------------|-----|------------|-----------|-----------|------------|
| Producers (₦/ha) | Central Zone | 66 | 206663.98 | 49817.26 | 115122.50 | 334804.17 |
| | Western Zone | 110 | 261635.82 | 67005.41 | 142000.00 | 520275.00 |
| | Northern Zone | 125 | 261644.14 | 97306.28 | 123256.67 | 813658.33 |
| Wholesaler (₦/month) | Central Zone | 26 | 791151.92 | 314997.76 | 312300.00 | 1309750.00 |
| | Western Zone | 37 | 870218.44 | 514750.29 | 254050.00 | 2867200.00 |
| | Northern Zone | 47 | 1431681.81 | 916758.42 | 258150.00 | 4028000.00 |
| Retailers (₦/month) | Central Zone | 50 | 29 8172.00 | 147753.09 | 100200 | 725530 |
| | Western Zone | 130 | 236468.61 | 144162.73 | 73470 | 725570 |
| | Northern Zone | 72 | 198419.39 | 87575.92 | 100060 | 531500 |
| Actors | | | | | | |
| State | Producers | 301 | 238115.38 | 78517.25 | 115122.50 | 805658.33 |
| | Wholesaler | 105 | 1101107.48 | 751240.09 | 253450.00 | 4026350.00 |
| | Retailer | 252 | 237840.14 | 135219.72 | 73470.00 | 725570.00 |

Source: Field survey (2017)

In Table 4, the mean total cost incurred by Central zone retailers was ₦298172.00, Western zone retailers was ₦236468.61, and for Northern zone was ₦198419.39. The average total cost of ₦238115.38, ₦1101107.48 and ₦237840.14 were incurred by producers, wholesalers and retailers in Bauchi state. Table 4 also presents the minimum and maximum costs incurred by the SCAs, per naira per hectare as in the case of producers, and per naira per month as in the case of wholesalers and retailers. Producers of Central, Western and Northern zones incurred average minimum total cost of ₦115122.50, ₦142000.00, ₦123256.67 and an average maximum total cost of ₦334804.17, ₦520275.00 and ₦813658.33, respectively. Wholesalers in Central, Western and Northern zones incurred average minimum total costs of ₦312300.00, ₦254050.00, ₦258150.00 and maximum total costs of ₦1309750.00, ₦2867200.00, and ₦402800.00 respectively. Retailers of Central Western and Northern zones incurred average minimum total cost of ₦100200.0, ₦73470.00, ₦100060.00 and an average maximum total costs of ₦725530.00, ₦725570.00 and ₦531500.00, respectively.

Total Cost differentials of Fresh Tomato Supply Chain Actors by Zones

Table 5 presents the result on how the total cost incurred by the supply chain actors varied significantly between Central, Western and Northern zones. Comparing among producers of fresh tomatoes, the result indicated no significant difference on the total cost incurred between Western and Northern zones. However, there were significant differences on the total costs incurred between Western and Central zones, Northern and Central zones on total cost incurred, respectively, at $P < 0.01$. The implication is that Western and Northern zones incurred higher total cost than Central zone, while Western and Northern zones incurred similar total cost. As regards to wholesalers, there were no significant differences on total cost incurred between Western zone and Central zone, implying that similar total cost were incurred by



Western and Central zones. However, there were significant differences at $P < 0.01$ between Western and Northern zones, Northern and Central zones.

Table 5: Total Cost Differentials of Fresh Tomato Supply Chain Actors among Zones

| Actors | Zones (i) Zone (j) | Mean difference (i-j) | Std. Error | Sig. | Lower bound | Upper bound |
|----------------------|----------------------------|-----------------------|------------|------|-------------|-------------|
| Producers (₦/ha) | WZ /CZ | 54971.84 | 12183.90 | .000 | 25715.45 | 84228.23 |
| | WZ/NZ | -8.32 | 10230.12 | 1.00 | -24573.23 | 24556.60 |
| | NZ/C Z | 54980.16 | 11906.61 | .000 | 26389.61 | 83570.70 |
| Wholesaler (₦/month) | WZ /CZ | 79066.51 | 183661.58 | .903 | -366786.11 | 524919.14 |
| | WZ/NZ | -561463.32 | 159424.69 | .002 | -948479.11 | -174447.63 |
| | NZ/CZ | 640529.89 | 170016.79 | .001 | 227801.04 | 1053258.73 |
| Retailers (₦/month) | WZ /CZ | -61703.39 | 21856.17 | .015 | -114243.58 | -9163.20 |
| | WZ/NZ | 380.49.22 | 19294.44 | .142 | -8332.82 | 84431.26 |
| | NZ/CZ | -99752.61 | 24178.15 | .000 | -157874.64 | -41630.59 |
| State | Actor (i) Actor (j) | | | | | |
| | Wholesaler/Producer | 862992.09 | 35740.72 | .000 | 777433.82 | 948550.37 |
| | Wholesaler/Retailer | 863367.33 | 36628.35 | .000 | 775584.19 | 950950.48 |
| | Retailer/Producer | -275.24 | 26925.09 | 1.00 | -64730.14 | 64179.66 |

Note: WZ = Western Zone; CZ = Central Zone; NZ = Northern Zone

Source: Field survey (2017)

The implication is that Northern zone incurred higher total cost than Central zone, while Western zone incurred higher total cost than Northern zone. In the case of retailers, the result shows significant difference between Western and Central zones. This implies that Central zone retailers incurred higher total cost as compared to Western and Northern zones. There was significant difference between wholesalers and producers, wholesalers and retailers at $P < 0.01$ this indicates that wholesalers incurred higher total cost than producers and retailers. There was no significant difference between retailers and producers.

CONCLUSION AND RECOMMENDATION

The study concluded that fresh tomato production and marketing in the study area was profitable among the supply chain actors. It can also be said that although tomato business was profitable in the study area, there was significant differences in both the net incomes obtained and costs incurred by the supply chain actors. The study recommended that decisions on production and marketing be adjusted and re-established so as to maximise their profits. Also, SCAs can sell their products online by registering their product and location. This will allow easy access of the product by customers and it will help broaden fresh tomato market, which in turn will increase the income of the supply chain actors in the study area. Information and communication technology (ICT) should be integrated into tomato business in Bauchi state so as to minimize the difference obtained in both net incomes and cost. This will be possible



through the provision of accurate, timely and relevant information on both prices of fresh tomato product and inputs.

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