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THE ACTUAL AND POTENTIAL MARKET FOR CASSAVA IN GUYANA

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Disclaimer

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1. Executive Summary

Profiling the actual and potential market for cassava has been the primary focus of this study. Utilising a stepwise approach, data were first analyzed generally, and then by regions and finally regional clusters. Based on the analyses, four separate but not mutually exclusive results were generated. Yields are overall relatively low; the value chain is characterised by loose marketing arrangements undertaken predominantly between farmers and wholesale traders in an oligoposonistic market setting; there is a lack of commercially scaled cassava processing operations; the cassava value chain is weak and undeveloped.

Low yields are indicative of low productivity and by extension sub-optimal profitability. The lack of adequate market outlets has been discovered to be the major driver in the general attitude amongst farmers. Given that there is an absence of adequate market outlets there is no real priority in practicing better crop husbandry as it is already a challenge to market the output as it is with the current yields. Typical marketing arrangements between farmers and traders are almost exclusively void of any legally binding agreement thereby heightening the risk factor particularly in the case of farmers. The absence of legally binding orders exposes farmers to an often volatile market for their produce. Further, the limited presence of vibrant farmers' marketing organizations at the community level particularly, reduces farmers' ability to negotiate more favourable prices and secure advance orders. The lack of commercially scaled cassava processing operations puts an avoidable constraint on the size of the cassava market. Farmers under the current scenario are heavily restricted to selling to traders. With the presence therefore of an expansion of commercially scaled processing operations, this would provide a much needed and potentially sustainable avenue for farmers' produce and act as a stimulus to farmers for the improvement in yields and ultimately production in the sector.

The combination of poor yield, loose marketing structures and lack of commercially scaled processing operations presents the scenario of a weak and undeveloped cassava value chain whose performance is suboptimal. In the light of these findings, a number of strategies specifically targeting the identified concerns have been recommended.

2. Introduction

Cassava is generally regarded as the most important root tuber crop in Guyana, and the staple food commodity for a significant segment of Guyana's population. Cassava is commonly referred to as either "Sweet" or "Bitter" types as a distinguishing classification of cyanide concentration. In the coastland areas of Guyana, the sweet type of cassava is used extensively for several food preparations but particularly boiled (and fried in some instances) and served as a meal. Further, a small number of edible cassava based products from the sweet type of cassava such as pones, chips and cassava/eggballs is produced for local markets. These products are more associated with the coastal areas as against the interior regions of the country.

Bitter cassava is the main type cultivated, processed and consumed in the interior regions. Given however that a higher concentration of cyanide is to be found is this type, the bitter cassava undergoes special processing in order to make it fit for human consumption. Generally, processing is done using traditional methods of the Amerindians whom reside in the interior regions. Among the products produced from the bitter cassava, are tapioca cassava bread, farine, cassareep, and beverages such as Paiwari.

While cassava is cultivated in all of the ten administrative regions in Guyana, the highest production is observed in Regions 1, 8 and 9, which are inhabited predominantly by Amerindians.

Cassava is produced mainly on small-size farms, from 0.1 to 2.0 hectares. Approximately 2000 hectares are cultivated each year; production is mainly manual; or partially mechanized. The average yield was 11.02t/ha in 2004. Most cassava is consumed locally; exports are negligible and mainly in the form of cassareep. An important limiting factor affecting the marketing and consumption of cassava in its fresh state is its poor shelf life and high rate of deterioration and spoilage occurring during storage. Practices have been developed to assist in improving the post harvest quality characteristics of this perishable commodity. Given the low use of chemicals, Guyanese cassava production could in principle qualify for an "organic" label, which however requires a certification in order to be translated into an asset in marketing.

Cassava is a major staple food commodity for a significant segment of the Guyanese population. While potentially the crop is recognized as being widely versatile in its uses, the sector has remained sluggish in terms of productivity and development in its value chain. As such, in order to consider options for developing the cassava industry, there is need for additional and more accurate information as was expressed by the Ministry of Agriculture.

Based on the problem presented, this study was undertaken with the objective of profiling the actual and potential market for cassava in Guyana. Specifically, it seeks to assess and quantify the demand for cassava and the main cassava products and current production volumes.

As part of the analysis, both quantitative and qualitative information is provided on the location of identified actual and potential cassava consumers in Guyana, and importantly on the constraints preventing the development of the cassava value chain at those locations. This analysis serves the ultimate goal of aiding the process of the identification of appropriate strategies aimed at supporting the development of the cassava value chain in Guyana.

An understanding of the cassava production system in terms of structure and function and the regional or local system where cassava roots and products are produced and traded, along with the capacity of the country to develop the cassava industry, is prerequisite in the designing of suitable interventions for the sector. The paper utilises concepts drawn from the Agro-food Systems and Chains methodology developed by the Food and Agricultural Organisation[1]. Generally, the methodology will be used in giving guidance in the overall analysis of the cassava value chain in Guyana.

[1] The Agro-food Systems and Chains is Module 1 of the Course on Agribusiness management for Producers' Associations produced by the FAO Agricultural Management, Marketing and Finance Service Rural Infrastructure and Agro-Industries Division.

3. Sample Design and Data Collection

The information used in this study was collected at micro and village levels. The emphasis however was at the micro (family-household) level. Specifically, primary data was collected during the period June to September 2009 from a sample of farm households across Administrative Regions 1, 2, 3, 4, 6, 9 and 10. A structured questionnaire was administered to cassava farmers with questions broadly targeting cassava output at the individual farm level, utilization at the individual household level, and marketed volumes and prices received by individual farmers. Further, qualitative information was solicited from farmers regarding challenges surrounding the attainment of normal yields and marketing concerns such as pricing, and perceived causes as dictated by the market or otherwise, for the level of price received for the produce.

A cluster sample design was utilized. Clusters were selected based on naturally occurring districts throughout the administrative regions targeted in this study. From these clusters, cassava farming households were randomly selected. This approach was used since no reliable sample frame of cassava farmers could be accessed. Ninety cassava farmers were sampled from the following cassava cultivating areas as follows:

- Region 4: Six cassava farmers selected from Caledonia/Good Success;
- Region 10: Eleven cassava farmers selected from Linden;
- Region 3: Seventeen cassava farmers selected from Salem, Parika Backdam/Ruby, and Hubu;
- Region 2: Seven cassava farmers from Tapakuma;
- Region 9: 31 cassava farmers from Annai, Moco-Moco, Surama, and Kumu;
- Region 6: Nine cassava farmers from Orealla and Siparuta;
- Region 1: Ten cassava farmers from Tobago Village, Kamwatta Village, Arucuro; White Creek Village, Arucuro White Water and Upper St. Anslem's Village.

After having analyzed of the entire data set, the data was further analysed on a region (administrative region) by region basis. Given however that an objective of the study is the prescription of appropriate strategies for the development/improvement of the cassava value chain, the sample was sub-divided into two groups deemed to contain homogeneous cases

within, but heterogeneous as individual groups. The main criteria for differentiation have been, among other things, degree of market integration and pricing. The main destination of the marketed fresh cassava as well was considered as a secondary criterion in the classification process. Implied in this approach is the assumption that each classified group has broadly similar resource bases, enterprise patterns, household livelihoods and constraints amongst the regions captured in the specific grouping or cluster, and therefore, similar development strategies and interventions would be appropriate.

4. Results

4.1 Nation-wide results

Table 1: Output and Productivity

Variable	Mean Value/Volume	Standard Deviation
1. Total Area of Farm (acres)	7.5	9.4
2. Area of Farm Presently under Cassava Cultivation (acres)	2.7	3.6
3. Area of Farm Normally under Cassava Cultivation (acres)	3.5	5.2
4. Normal Cassava Output (lbs per acre)	7,808	3,650
5. Expected Cassava Output (lbs per acre)	8,472	4,076
6. Total Output per Household (yield per acre times no. of acres cultivated with cassava)	32,277	58,356

The table 1 portrays information of the output and productivity for the entire sample surveyed. This information sets the tone for the discussion in that it gives the overall picture of what pertains for the identified variables.

The table indicates that of the total area available on average to cassava farmers, just under one third is utilized for the purpose of cassava cultivation at the present time. This immediately suggests that in the portfolio mix of crops cultivated by the average farmer, only a small amount is dedicated to cassava. Some light may be shed on the reason for such a cropping pattern, as qualitative information from the survey is analyzed. Tentatively, it may be assumed that there is reasonable capacity for the expansion of cassava cultivation in light of the fact that only a small portion of available lands is presently under cassava cultivation. As it regards the area normally cultivated however, this amounts to just below 50% of the available lands. Even with this area of cultivation, there still remains substantial scope for expansion. Added to this fact, 27% of all interviewees indicated that the land cultivated with crops were titled lands, while 22% were state owned and another 20% leased or rented lands and 12% communal lands. Only 7% were squatted lands with 12% of lands accessed through informal

arrangements. This scenario augers well for prospects of expansion of cassava cultivation in the short to medium term, and long term stability of production as the major portion of farmers cultivate lands that are secured through stable arrangements. Farmers however faced by very few alternative markets, restrict themselves to production on a scale consistent to what is perceived to be handled by the traditional markets they serve. In both instances, the standard deviation was found to be relatively high, indicating that there was a wide spread in the data around the mean. This may be the result of the fact that the data may not necessarily be normally distributed. In addition, a wider dispersion in the data may be expected when analyzed at an aggregate level.

As it regards the normal cassava yield, an amount of 7,808 lbs per acre was observed. In this case the a priori expectations would dictate that the spread in the data around the mean would be pronounced, given that technology and inputs/resources employed among farmers across regions and clusters would be different. Specifically, soil type and to a less extent variety of plants may possibly have contributed to any spread in the data. From the results it can be extrapolated that 68% or of all the data points, i.e. 61 out of the 90 data points, fall between the values of 4,158 per acre lbs and 11,458 lbs per acre. A similar interpretation can be given for the case of expected cassava output per acre. This assumption holds true however where the data is assumed to be normally distributed. As was indicated, the spread around the mean is expected to be pronounced, given that data was being measured across vastly different regions in terms of the input/resources employed among farmers in production. The average in the case of expected yield is slightly higher than that of actual yield reported, indicating an overall positive outlook in output performance. This may be an indication of farmers' optimistic view in terms of their own capabilities in coping with the risks that they are routinely confronted by. Farmers in responding to the question of expected yield have factored in the enhanced knowledge acquired through experience of cultivating recent crops. The expected yield is only marginally higher (8%) than that of the actual reported yield.

The output figure of 7,808 lbs per acre compares reasonably well with figures garnered from secondary sources. The FAOSTAT statistics of the Food and Agricultural Organization of the United Nations (FAO) reports a figure of 9,713 lbs per acre for the year 2007. This survey's

estimate of yield is approximately 80% of the estimate presented by the National Agricultural research Institute. The expected yield from this survey amounts to 87% of the FAOSTAT 2009 estimate.

As it regards the overall output per cassava farming household captured in the survey, a figure of 32,277 lbs was estimated. According to data gleaned from secondary sources, an amount of 44.4 million lbs of cassava was produced in 2007 with 4,572 acres cultivated for the same period[2]. This information is based on yield of 9,714 lbs per acre. Given that this survey estimates yield at 7,808 lbs per acre which is 80.4% of the FAOSTAT 2009 estimate, an extrapolated figure of 35.7 million lbs (16,225 tonnes) of cassava would be computed. The discrepancy of 20% between this study's estimated yield and that of the FAOSTAT 2009 source cannot easily be explained, given that farmers do not typically keep records of their yields. This is further compounded by the nature of the crop being dealt with. Harvesting of a crop is hardly ever done in one instance, but rather over a period spanning several weeks thereby presenting opportunities for additional discrepancies. This said, it was observed during the course of this survey that farmers routinely overestimated yields. This was done very often inadvertently, as no genuine records were made of harvest weights. To a large extent farmers relied on their powers of recall of sales quantities as an aid in arriving at yields. Given this observed tendency of farmers to overestimate yields, farmers were asked to reconsider their estimates and to justify how they arrived at their previous estimate; a process which usually resulted in a revised estimate that was lower than their previous, with many of these revised estimates roughly in the region of about 80% of their previous estimates.

While the focus of the survey was not specific to variety or type of cassava cultivated, some amount of information was captured regarding the percent of acreage under cultivation by type (bitter or sweet types). Of the 90 farmers surveyed, 39% cultivated sweet cassava, while 37% cultivated the bitter type. 24% of farmers planted a significant percentage of both sweet and bitter types. While many farmers planted both types, only the significant percentages were captured.

[2] FAOSTAT 2009.

29% percentage of the farmers interviewed attributed pest attack for observed fluctuations in yields. Only 10% and 13% was attributed to poor weather and other causes respectively.

Table 2: Household utilization of Cassava Produced

Variable	Mean Value/Volume	Standard Deviation
1. Volume of Output Consumed by Household (lbs-fresh cassava)	5,439	6,537
2. Percentage of Output Consumed by Household (fresh cassava)	45	38

The table 2 portrays information of the utilization of household cassava produce for the entire sample surveyed. The information embedded in this table attempts to give an indication of the percentage of cassava that is used for subsistence purposes. This information is necessary in order to arrive at an estimate of the marketed percentage of all cassava produced.

The first striking point of the data in table 2 is the fact that the standard deviation for both variables appear to be somewhat high. This indicates a high spread in the data, which can again be attributed to fact that at the aggregate level, a higher degree of heterogeneity in the data is to be expected. This may be the result of data skewness resulting from the relatively high volumes of cassava utilized by households in certain locales that cultivate cassava mainly for subsistence purposes. Regarding the percentage, the standard deviation appears comparatively lower. An important observation is that the ratio of the mean to the standard deviation for the volume of output consumed compared to percentage of output consumed is vastly different (.83 compared to 1.18 respectively). This further supports the notion that there is a relatively high spread in the data attributed to the stark difference in cassava consumption patterns across regions or clusters. The specific pattern shows higher standard deviation compared to the mean for the volume with the inverse for the related percentage. This suggests that there was a high percentage of output consumed by a large percentage of the households (presumably those located in regions where cassava constitutes their main staple), while for an equally large proportion of the households, a very small percentage of output was consumed (presumably

those located in regions where cassava traditionally does not constitute a major part of their diet). The table shows that an average of 45% of all production is consumed by the household.

Table 3: Market and Pricing

Variable	Mean Value/Volume	Standard Deviation
1. Marketed Output of Fresh Cassava (lbs)	20,980	58,243
2. Percentage of Output Sold on Market	39	32
3. Normal Price Cassava Sold at (G$ per lb)	28	13
4. Expected Price[3] Cassava Sold at (G$ per lb)	32	12

Table 3 conveys information regarding market and pricing issues. A similar observation regarding the wide dispersion of data is made for output and productivity, as well as for household utilization. The amount of 20,980 lbs is estimated as the average amount of cassava that is marketed per crop. Using the average yield estimated in the survey, this translates to produce from 2.7 acres of the average 3.5 acres normally cultivated with cassava by the average household. This translates into 39% of all cassava produced arriving at the market.

Regarding output prices, data was much less dispersed, indicating strong uniformity in prices received and expected. An average of G$28 was estimated as price per lb of cassava with a modest 14% increase in price to G$32 per lb in expectations of future price.

As it regards the actual market destination of the produce, the survey found that the major percentage of marketed cassava was sold to wholesalers. This percentage is in the vicinity of 42%. A significant percentage was found to have been sold directly to consumers in the community. A minute 1% of produce was sold to processors. Processors referred to here are the milling entities specifically established for processing cassava. Mills are primarily involved

[3] Expected Price is the price that farmers declared they believed they would receive in the next production cycle or crop. Farmers were asked "what price (per lb) do you expect to receive for your cassava in the next crop?" Farmers were encouraged to utilize their own understanding of the interplay of market forces and the direction these forces were moving in, in arriving at the "Expected Price".

in basic value addition, such as production of cassava bread, farine, cassareep. Examples are the Tapakuma Cassava Processing Facility in Region 3, and other community operated small mills to be found in Region 9. This paints a clear picture as to the poorly developed state of the cassava value chain. Clearly any processing or value addition to the produce is conducted almost entirely by the cassava farming households themselves.

4.2 Regional level results

Analysis of the data covering the seven administrative regions captured in the survey starts out with the observation that these administrative regions were found to be statistically different in terms of the variables analyzed at the 5% significance level as measured by the Kruskal-Wallis Test. This indicates that production and productivity, utilization and marketing are significantly different between regions.

Table 4 conveys production and productivity across the regions included in the survey. Of the administrative regions analyzed, regions 2, 6 and 9 appear to have a high percentage of the available farm lands cultivated with cassava. Regions 1, 3, 4, and 10 have a relatively low percentage of farmed land cultivated with cassava, suggesting good prospects for expansion. This conclusion must however be taken with some degree of caution, given that while there are vast lands available particularly in region nine, lands are only brought under cultivation based on mainly family needs or primarily for subsistence purposes. Hence actual acreage of plots of lands cultivated with any crop will typically be low and given the importance of cassava as a staple in such locations, the percentage of cassava cultivated to all lands cultivated will be high. In actual fact, there are enormous possibilities for expansion of the crop given the vast amount of lands available particularly in the identified locale.

Regarding the actual yield observed in the survey by region, this compares well with the national average taken from secondary source[4]. Regions 1, 3, 4, and 10 generated yields relatively close to the national average garnered from secondary sources, with region 3 registering the highest discrepancy with an overshooting of approximately 20%. Regions 2, 6,

[4] An extrapolated national average based on FAOSTAT 2008, averages the national yield at approximately 9,714 lbs per acre.

and 9 generated modest results in comparison to the identical national average, with region 9 registering the highest discrepancy of an undershooting of approximately 44%. This, however, is to be expected in light of the fact that the national yield average gleaned from secondary sources has no real bearing on regional averages where, terrain, soil type, types of pests and husbandry can be vastly diverse.

Regarding the output per farm household by region, this result was widely varying. This result of course is a function of both acreage cultivated, and yield per acre on a region by region basis. It would be expected therefore that region 6 given its low yield and low acreage cultivated on average observed in this study, would generate low output. This is in direct contrast to the case of region 4 with relatively high averages in both yield and acreage cultivated.

As was mentioned, while the focus of the survey has not been specific to variety or type of cassava cultivated, broad information was captured as to the major type of cassava cultivated (bitter or sweet) on a regional basis. Of the farmers interviewed, all planted bitter cassava exclusively in Regions 1 and 2, with significant amounts of both being planted in Regions 6 and 9. On the other hand, sweet cassava was planted exclusively in Regions 3, 4 and 10.

As it regards reasons identified for variation in output, regions 2, 3 and 9 attributed pest infestation as the main hindrance in this respect, with a somewhat even split between weather constraints and pest infestation for regions 1 and 6. Regions 4 and 10 however attributed other concerns.[5]

[5] Destruction of plants by wild animals appeared to be the main reason for differences between observed and expected output.

Table 4: Output and Productivity (regional)

Variable	Mean Value/Volume						
	Reg. 1	Reg. 2	Reg. 3	Reg. 4	Reg. 6	Reg. 9	Reg. 10
Total Area of Farm (acres)	12	1.8	13.8	20.4	1.4	2	10.2
Area of Farm Presently under Cassava Cultivation (acres)	3	1.8	4.8	7.5	1.1	1.5	1.9
Area of Farm Normally under Cassava Cultivation (acres)	3.7	2.2	6	13.3	1.1	1.5	2.1
Normal Cassava Output (lbs per acre)	8,400	7,167	11,647	9,000	5,811	5,403	9,445
Expected Cassava Output (lbs per acre)	13,700	7,167	11,029	11,333	6,222	5,177	10,045
Total Output per Household (yield per acre times no. of acres cultivated with cassava)	30,600	15,167	72,412	126,333	5,944	8,355	18,768

Table 5 portrays information on the utilization of household cassava produce on a regional basis. This information attempts to give an estimate of the marketed percentage of all cassava produced at the regional level.

The table shows that a relatively high percentage of cassava in either processed or unprocessed form is utilized by the typical cassava-farming household in regions 1 and 9 in the vicinity of 91% and 86% respectively. Region 2 follows next, with 69% which is greater than two-thirds of the amount produced. Relatively lower percentages are observed in regions 3, 6 and 10 with 46%, 34%, and 41% respectively; all amounting to less than half of household output. Region 4 is a standout with a meagre 3%.

Table 6 gives closely related information to table 5. Given the high rate of consumption of fresh and processed cassava from household farm observed in Regions 1 and 9, only a low percentage of all output reaches the market. The less pronounced case of region 2 follows next. As can be deduced, regions 3, 4, 6, and 10 all have relatively high percentages of their output marketed.

As it regards pricing, vast differences can be observed for fresh cassava between regions. Relatively higher prices are observed in Regions 10, 4, 6 and 3, in descending order.

As it regards the actual market destination of the produce, the survey found that the major percentage of marketed cassava is sold to wholesalers in regions 3, 4, 6 and 10, while for regions 1, 2, and 9 most of the produce is sold to consumers in local market, directly by producers. Only in regions 1 and 2 small percentages were observed being marketed to a processor. This highlights the fact that when analyzed regionally as well, the cassava value chain appears to be poorly developed, with much scope for its enhancement either from a regional perspective or as regional clusters.

With respect to reasons attributed for price variation observed by farmers, only regions 1 and 2 attributed high demand on market as main reason. Regions 3, 4 and 10 attributed high supply on market as main reason with region 2 having an equal split between high demand and high supply on market. Region 6 attributed low demand on market as contributing to price swings while

region 9 attributed same to low supply on market. This information is based on highly subjective perceptions formed by farmers based on prices observed over several crop cycles.

Table 5: Household Utilization of Cassava Produced (regional)

Variable	Mean Value/Volume						
	Reg. 1	Reg. 2	Reg. 3	Reg. 4	Reg. 6	Reg. 9	Reg. 10
1. Percentage of Cassava Consumed by Household (fresh and processed)	91	69	46	3	34	86	41

Table 6: Market and Pricing (regional)

Variable	Mean Value/Volume						
	Reg. 1	Reg. 2	Reg. 3	Reg. 4	Reg. 6	Reg. 9	Reg. 10
1. Marketed Output of Fresh Cassava (lbs)	3,136	6,083	49,585	124,837	3,921	1,402	13,602
2. Percentage of Output Sold on Market	9	31	54	97	66	14	59
3. Normal Price Cassava Sold at (G$ per lb)	17	21	25	34	28	20	54
4. Expected Price Cassava Sold at (G$ per lb)	22	27	28	40	31	27	53

4.3 Results for Regional Clusters

From the analysis, a noticeable pattern appears to be emerging regarding the clustering of the regions surveyed. The higher prices observed appear to be associated with the regions where a high percentage of the output is marketed, while the lower prices are associated with the regions where greater subsistence farming of cassava is observed. This is consistently so for both normal price cassava was reported to have been sold at for last crop and for the expected price cassava is to be sold for the subsequent crop. As a matter of fact the only anomaly that presents itself when percentage of marketed output is ranked against price is that while Region 4 is observed to market the highest percentage of fresh cassava, followed by Regions 6 and 10 respectively, the highest price is observed in Region 10 followed by Regions 4 and 6 respectively. Nevertheless, the remaining regions are perfectly matched in terms of the observed pattern described. To a large extent this was an expected result, since it is in the less market-intensive regions precisely where cassava is more grown and consumed as the staple. Hence, prices would ceteris paribus be expected to be lower in such areas. Moreover, other analyses of marketing concerns, such as destination of produce by region, gives rise to not dissimilar conclusions regarding much homogeneity within the two distinct clusters of regions and heterogeneity between clusters. Based on this observed pattern therefore, the sample will be subdivided into two broad clusters based on the observed similarity within each cluster regarding percentage of marketed output/percentage utilization of output, prices observed, and market destination of output observed. The hypothesis that these clusters are dissimilar as it regards the identified underlying quantitative factors will be tested using the Mann-Whitney Test[6].

In addition, given that an objective of the study is the prescription of appropriate strategies for the development/improvement of the cassava value chain, this subdivision of the sample into two clusters serves this objective. Implied in this approach is the assumption that each classified group has broadly similar resource bases, enterprise patterns, household livelihoods and constraints, and therefore, similar development strategies and interventions would be appropriate.

[6] The Mann-Whitney Test is a nonparametric equivalent to the t test and tests whether two independent samples are from the same population. See KINNEAR, P. and C. Gray (2004) SPSS 12 Made Simple. Psychology Press, Hove and New York.

Based on this approach then, these two clusters will be comprised as follows:

Cluster 1: Regions 1, 2, and 9.

Cluster 2: Regions 3, 4, 6 and 10.

Figure 1: Map of Guyana showing Clusters.

The figure above shows the various regions surveyed in this study and highlights the clusters.
Of importance is the fact that Regions 1, 2 and 9 are regions where cassava is the staple or constitutes an important part of the diet and as such these regions would naturally be the regions with relatively lower marketed percentages of the output. The opposite applies to Regions 3, 4, 6 and 10.

Analysis of the data covering the two identified clusters of regions captured in the survey starts out with the observation that these two clusters were found to be statistically different in terms of the variables analyzed at the 5% significance level as measured by the Mann-Whitney Test. This indicates that based on the criteria of degree of market integration and prices, the hypothesis that the identified groups are statistically different at the 5% level of significance, can be accepted. As a test of robustness of the classification, all the other important quantitative variables were analyzed using the Mann-Whitney test to ascertain whether based on these additional factors the two clusters would still remain statistically different. The result confirms earlier indications. Only in one out of these

quantitative variables analyzed presented statistics suggesting that clusters were not significantly different. The remaining variables all indicate that clusters were statistically different at the 5% level. The variable referred to is 'Total Area of Farm Presently Under Cassava Cultivation (acres)'. Nevertheless, a related variable same being 'Total Area of Farm Normally Under Cassava Cultivation' (acres) turned out to be statistically significant in terms of difference between the clusters. Further, when the actual figures for Total Area of Farm Presently under Cassava Cultivation for both clusters were compared with the Total Area of Farm Normally under Cassava Cultivation, it was noted that while both increased, the increase was much more pronounced in the Cluster 2, hence the statistical results of significant difference between the two clusters for Total Area of Farm Normally Under Cassava Cultivation.

Table 7: Output and Productivity (by Regional Clusters)

Variable	Mean Value/Volume	
	Cluster 1	Cluster 2
1. Total Area of Farm (acres)	4.6	12.7
2. Area of Farm Presently under Cassava Cultivation (acres)	2	4
3. Area of Farm Normally under Cassava Cultivation (acres)	2.3	5.6
4. Normal Cassava Output (lbs per acre)	6,200	9,854
5. Expected Cassava Output (lbs per acre)	7,457	10,189
6. Total Output per Household (yield per acre times no. of acres cultivated with cassava)	15,629	59,220

Table 7 conveys production and productivity across the identified clusters captured in the survey. Cluster 1 appears to have a relatively higher percentage of the available farm lands cultivated with cassava compared to Cluster 2. This fact however must be put into perspective. The regions captured in Cluster 1 are characterized by more subsistence-type farmers[7] whom market a relatively lower percentage of their cassava compared to those in Cluster 2. Given that cassava often is the staple diet of households in Cluster 2, a larger percentage of their lands would be dedicated to this crop. Note however that even so, the actual area cultivated is relatively lower than that of Cluster 2, since marketing does not appear to be the priority for these households. Their acreage is more a reflection of their consumption needs as compared to their larger more market oriented counterparts in Cluster 2.

[7] Subsistence farmers are referred to in the context of this paper as those whose market surpluses constitute less than 20% of total output.

Yield observed in the survey are significantly lower in Cluster 1 compared to Cluster 2. As a matter of fact this yield is 36% lower than the notional national average of 9,714 lbs per acre. This is in stark contrast to the observed yield for Cluster 2 of 9,854 lbs which is just slightly higher (approximately 1%) than the notional national yield. This can partially be attributed to reasons such as type of terrain, soil type, presence of pests, drainage and irrigational facilities; a discussion beyond the scope of this study. Crop husbandry, however, remains the strongest explainer of the observed stark differences in yields between the two clusters. Given that farmers in the Cluster 2 are more commercially driven, better crop husbandry practices would be exercised as compared to Cluster 1, whose foremost concern is that of satisfying household cassava consumption needs. As such there is much scope for vast improvement in yields for Cluster 1 with more dedicated crop husbandry practices.

Regarding the main type of cassava cultivated based on clusters, bitter cassava was cultivated predominantly in Cluster 1 while sweet cassava was predominantly cultivated in Cluster 2. This outcome was expected as Cluster 1 comprises farmers mostly whom cultivate and process their cassava for home consumption. This usually takes the form of rudimentary processing of the fresh cassava into farine, cassava bread, beverages and sauces such as cassareep, all of which are by-products of the bitter type of cassava. On the other hand Cluster 2 is comprised of mostly farmers whom market a significant proportion of their produce and use a relatively small amount for supplementing their diet which comes from the sweet type of cassava.

As it regards reasons identified for variation in output between clusters, Cluster 1 attributes ‘pest infestation’ as the main concern in this respect while Cluster 2 attributes the less specific ‘other causes’ to the variation. The responses in the category ‘other causes’, were related primarily to losses due to poor drainage.

Table 8: Household Utilization, Marketing and Pricing of Cassava Produced (by Regional Clusters)

Variable	Mean Value/Volume	
	Cluster 1	Cluster 2
1. Marketed Output of Fresh Cassava (lbs)	2,874	46,869
2. Percentage of Output Sold on Market	18	63
3. Normal Price Cassava Sold at (G$ per lb)	20	34
4. Expected Price Cassava Sold at (G$ per lb)	25	37

Table 8 combines main utilization estimates with marketing estimates. The percentage of cassava utilized by households is vastly dissimilar between clusters as would be expected. This is so since Cluster 1, which comprises the more subsistence type farmers, would utilize a relatively higher percentage as compared to Cluster 2, which is comprised of more market-oriented farmers. The percentage of marketed output for Cluster 1 and Cluster 2, of 18% and 63% respectively would naturally result. Actual volumes of marketed output therefore are reflective of this.

Normal prices observed and expected are relatively higher in Cluster 2 compared to Cluster 1. With respect to reasons attributed for price variation observed by farmers, a high percentage of farmers in Cluster 1 attributed high demand on market as main reason, while for Cluster 2 it was high supply in market. The result for Cluster 1 was somewhat surprising, as a high demand in market would suggest higher prices relative to Cluster 2. The only conclusion that can be drawn is that since farmers in Cluster 1 are not market oriented, the price received may be seen as satisfactory. The result for Cluster 2 appears more consistent as farmers were generally of the impression that prices were too low, and their responses were reflective of this perception.

As it regards the market destination of output, the majority of farmers (close to 50%) in Cluster 1 sold their surplus directly to persons in the local market and approximately 20% of their surplus was sold to small buyers whom would then retail the product. In the case of Cluster 2, the market destination was not as diversified. As a matter of fact, close to 90% sold their produce directly to wholesalers.

5. Mapping of Production Clusters

The analyses immediately preceding this section attempted to classify the surveyed farmers based on simple criteria involving the degree of market integration and pricing, along with other secondary criteria. With this classification made, it would now be possible to construct agrofood chains for each of these classified groups.

Essentially, an agrofood chain would comprise several components including the following[8]:

- Production
- Harvest and Post Harvest
- Marketing
- Transportation and Storage Operations
- Manufacturing
- Preserving and Processing Activities
- Final Distribution and Consumption

This description of an agro-food chain however describes a relatively developed food chain. In the case of the local cassava industry, the chain is not developed.

[8] The Agro-food Systems and Chains is Module 1 of the Course on Agribusiness management for Producers' Associations produced by the FAO Agricultural Management, Marketing and Finance Service Rural Infrastructure and Agro-Industries Division.

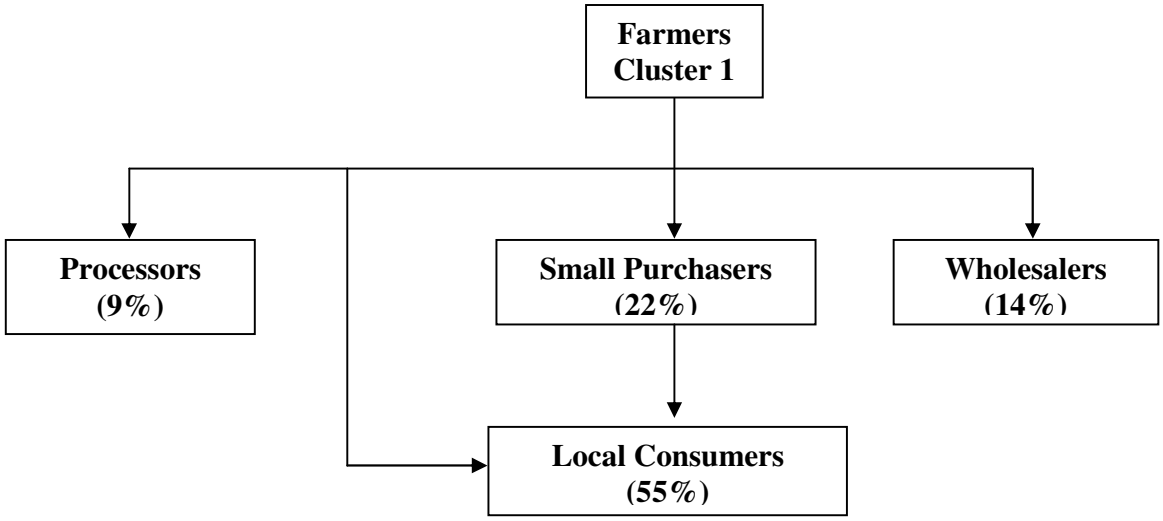

Figure 2: Cassava Value Chain for Cluster 1

Figure 2 gives an indication of the flow of cassava produce from farm to final users in a local context for Cluster 1. Farmers sell their produce primarily to local consumers directly with relatively smaller amounts being sold to small purchasers, wholesalers and processors. This diagram immediately suggests that only very little processing is done level and the market in this present stage of value chain development is primarily in fresh cassava.

Cash Flow Statement of Tapakuma Cassava Processing Facility-2009

Calendar Year	2009	2010	2011	2012	2013	2014	2015
End of Notional Year	0	1	2	3	4	5	6
CAPITAL COSTS							
Refurbishing of Unit	12,160,000						(6,080,000)
Solar Dryer	570,000						(285,000)
Working Capital		500,000					(500,000)
1. TOTAL CAPITAL COSTS	12,730,000	500,000	-	-	-	-	(6,865,000)
OPERATING COSTS:							
Fuel		230,400	230,400	230,400	230,400	230,400	
Wages		1,872,000	1,872,000	1,872,000	1,872,000	1,872,000	
Material		1,832,400	1,832,400	1,832,400	1,832,400	1,832,400	
Marketing and Transportation		384,000	384,000	384,000	384,000	384,000	
Maintenance		75,000	75,000	75,000	75,000	75,000	
2. TOTAL OPERATING COSTS	-	4,393,800	4,393,800	4,393,800	4,393,800	4,393,800	-
3. TOTAL COSTS 1 & 2	12,730,000	4,893,800	4,393,800	4,393,800	4,393,800	4,393,800	(6,865,000)
4. REVENUE	-	6,364,800	6,364,800	6,364,800	6,364,800	6,364,800	-
5. PROJECT'S NET CASH FLOW (4-3)	(12,730,000)	1,471,000	1,971,000	1,971,000	1,971,000	1,971,000	6,865,000
4. REVENUE	-	6,364,800	6,364,800	6,364,800	6,364,800	6,364,800	-
5. PROJECT'S NET CASH FLOW (4-3)	(12,730,000)	1,471,000	1,971,000	1,971,000	1,971,000	1,971,000	6,865,000

The cash flow above depicts the average situation of the Tapakuma Cassava Processing Facility. This facility is community owned and operated and stands to earn an internal rate of return of roughly 6% over the five-year period captured in the cash flow. While this rate of return is well in excess of the relatively risk free fixed deposit rate, it is quite modest by processing enterprises' standards locally. The main reason for such poor performances link directly to the inefficiencies alluded to in the final chapter of this document; poor coordination between farmers and the facility and poor coordination between the facility and the final market all of which result in suboptimal product mix, inefficient operating scale and ultimately in weak financial performance. Added to this, poor managerial knowledge of branding and packaging negatively impact the final price the facility receives for its products.

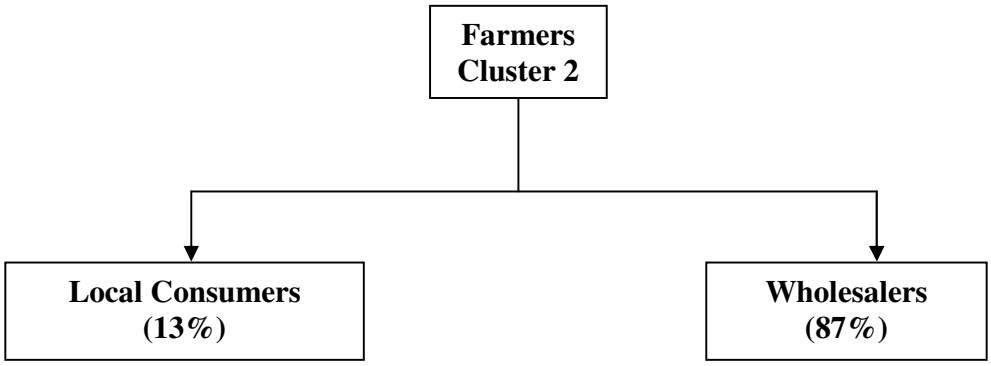

Figure 3: Cassava Value Chain for Cluster 2

Figure 3 gives an indication of the flow of cassava produce from farm to final users in a local context for Cluster 2. Markets are less diversified compared to Cluster 2. Farmers sell their produce primarily to wholesalers with a relatively small amount being sold directly to local consumers. No processing is done according to the sample drawn for this study; and like the case of Cluster 1, the market is primarily fresh cassava.

As it regards the major wholesale and retail markets in each region, marketing arrangements are generally undertaken on an individual basis. In some instances farmers sharing a general geographic space would carry produce to a central spot to sell to a pre-determined purchaser. Given the nature of such marketing arrangements therefore, numerous wholesale arrangements may take place in as many varied locations as against a fixed location. In the case of retail markets however, the principal municipal markets around the country are the main retail trading areas. Bartica, which is located in Region 7 (Cuyuni-Mazaruni) and considered to be the gateway to the gold mining areas, functions as a main cassava transshipment point for cassava and cassava-related products destined for mining locations deeper in Region 7. Figure 4 below gives a general indication of the locations of the main functioning cassava processing mills and the main locations where cassava is retailed in the country.

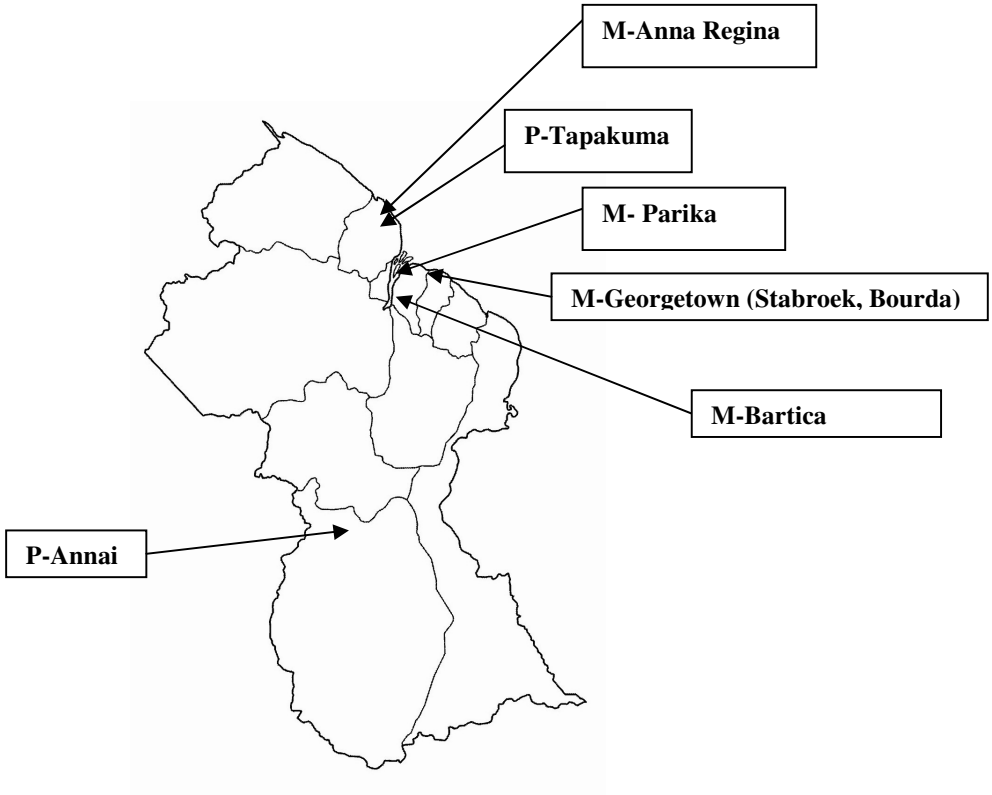

Figure 4: Main Cassava Processing and Market Centres

Key

P- Cassava Processing Plants

M- Major Retail Market Locations

6. Conclusions and Recommendations

The primary objective of this study was profiling the actual and potential market for cassava products along with current production volumes locally and the assessment and quantification of demand for cassava and cassava products. The rarity of cassava processing on commercial scales suggests that the product is consumed primarily, with very little transformation. As such, much of the analysis has been focused on cultivation and marketing.

The following important observations can be drawn from the study:

1. Yields are relatively low (even more pronounced in cluster 1);
2. The existence of a weak and undeveloped value chain creates avoidable hardships for all actors at all levels in the cassava sector;
3. Marketing arrangements are predominantly loose and the bulk of the market appears to be oligopsonistic in nature;
4. There is a lack of commercially scaled cassava processing undertakings.

The above mentioned observations are basically shortcomings that contribute to the relatively undeveloped state of the cassava value chain that exists at present. As such the proposed interventions/strategies are aimed at addressing these concerns.

The first observation is a serious constraint of the sector. Low yields are indicative of low productivity and by extension sub-optimal profitability. The lack of adequate market outlets appears to be a major driver in the formation of attitudes on the part of farmers. The general attitude amongst farmers is that due to inadequate market outlets there is no real priority in practicing better crop husbandry as it is already a challenge to market the output as it is with the current yields. The estimated yield arrived at from all the regions surveyed amounts to 7,808 lbs per acre. This is just around 80% of the national average estimated from secondary sources. While the average for Cluster 2 slightly overshoots the national average, the average for Cluster 1 is just about 64% of the national average. In any case, the average of 7,808 lbs per acre arrived is still below the yield observed for Latin America and Caribbean Countries (North America excluded)[9] which amounts to 8,922 lbs per acre. While the average estimated from this study (7,808 lbs per acre) is slightly higher than the average yield for the Caribbean countries (7,308 lbs per acre), it is well below the yield observed in

[9] FAOSTAT 2008

for instance Jamaica (16, 559 lbs per acre) and Barbados (16,026 lbs per acre). In relation to South American countries (when Guyana is excluded), the yield observed in this study is just 73% of that observed in the South American countries (10,652 lbs per acre) and well below the 22,405 lbs per acre registered by neighboring Suriname. As it regards Central America countries the yield observed in this study is below the Central American yield of 8,892 lbs per acre. Looked at from the perspective of the clusters, much scope remains for yield growths in both clusters but particularly for Cluster 1 which will ultimately impact significantly on national production as Cluster 1 comprises two of the largest cassava growing regions (Regions 1 and 9). Farmers being a critical link in the cassava value chain, would need to take measures supported by the Ministry of Agriculture through enhanced extensions services, along with other institutions such as the Inter-American Institute for Cooperation (IICA), the Food and Agricultural Organization of the UN (FAO) and agencies such as CLAYUCA through technical cooperation, in ensuring yields are drastically improved and production is undertaken on a scale in order to exploit scale economies.

The second observation is not mutually exclusive of the third and fourth identified. Operators in the value chain exist as if they are separate and unconnected, thereby foregoing the benefits that could be derived from forging a more connected but structured relationship. The limited use and limited presence of vibrant farmers' marketing organizations at the community level, for instance, reduces farmers' ability to negotiate more favourable prices and secure advance orders. At the same time, traders are known to have offered farmers marginally higher prices than the going rate at times, to secure supplies resulting in wrong price signals being transmitted to farmers. With the creation of better traders' networks such actions can be reduced if not avoided and thereby create a much more predictable and stable market for all. Such initiatives however would require the further support of organizations such as the Guyana Agricultural Producers' Association (GAPA).

The third observation has to do with the nature of marketing arrangements between the farmers and purchasers. The typical buyers are traders whom buy from different farmers in a given location and distribute these purchases to other smaller purchasers and retailers. Only a small portion of total farmers' output goes directly to the retail market according to observation in this study. The typical marketing arrangement between farmers and these traders is almost exclusively void of any legally binding agreement. Marketing arrangements are relatively straight-forward. Produce is usually sold to

wholesale purchasers who have well located groceries, particularly in the fresh vegetable markets throughout the country. These dealers would visit the study area with vehicles and make purchases at central locations, at which time farmers are paid in cash. The market structure appears to be relatively competitive at a first glance in that there are numerous buyers and sellers trading in similar items at a relatively set price. In actual fact however, while there are numerous buyers, they are relatively few in comparison to the amount of farmers. Added to this, farmers seem to be predisposed to the practice of selling to a particular dealer even though they receive more or less the going price on the market and they have the option of selling to others. This apparently has to do with the recognition by farmers that when the particular produce is in high supply at the main selling centres, their loyalty by supplying regularly to a particular dealer would work to their benefit since they would have a guaranteed market at such times. In the absence of any formal arrangement between the farmers and buyers however, farmers under such market conditions still receive reduced prices. From the foregoing, one can assume with some degree of confidence that the market is not competitive. To a certain extent, buyers are able to exert a certain amount of market power, even if tacitly. For one thing, even though there are many buyers in the market, their number by no means matches those of the selling farmers. This suggests a more oligopsonistic structure as against the seemingly competitive appearance. This scenario pertains mostly to Cluster 2. In the case of Cluster 1, marketing arrangements are loose as well, but markets are more diversified. It is however envisaged that with improved yields and over expansion, the proposal for value chain strengthening through the creation of farmers' marketing organizations where farmers can possibly collectively market their produce and through which guaranteed prices and quantities can be negotiated by way of legally binding contracts with purchasers.

The fourth observation that there is a lack of commercially scaled cassava processing operations is extremely critical for the expansion of the cassava sector. The creation of large-scaled cassava processing would provide a ready market for expanded cassava output and create opportunities for value-addition with stability in prices which possibly can feed back to cassava farmers. More specifically, privately owned and/or community-owned commercially scaled mills are the type envisaged in this study. While a more detailed financial cost-benefit study would be required to assess the profitability such commercially scaled cassava operations, a number of points can be made highlighting the characteristics of such an operation. An efficiently run private-community type

partnership involving organic pineapples exists locally[10]. This kind of private-community partnership is preferred in light of the limited opportunities for raising the kind of capital required to establish such a mill by the locals, whom nevertheless can be contracted to farm specific acreages with the supply purchased by the mill. This would help to guarantee steady supply for the mill, while at the same time stabilizing prices for the farmers and guaranteeing them a ready market. These mills would be better served where there is easy access to farms and where vast tracts of suitable lands exist for expansion in order to be able to produce at economically feasible scales. Such requirements are better suited to Cluster 1 (particularly in Region 9 with its vast land resources). As seen, the Tapakuma Cassava Processing Facility in Region 2 is one of such a community run operation, which appears to suffer from insufficient coordination between producers and millers, as well as inefficient management and therefore attracts suboptimal benefits.

The product mix of these commercially-scaled mills will be dependent on among other things:

1. Type of market it intends to serve
2. Access to market

These mills should be market driven. In the first case the type of market intended to be served will be dependent on the demand of the community in which the mills are located, and in areas beyond the immediate community but feasibly accessible considering the logistics.

The farming systems observed by region and cluster, suggest that in their present state the development of the described commercially-scaled cassava processing mills will be dependent foremost on the strengthening of the value chain, particularly between farmers and potential millers. This process is prerequisite for the scale of operations envisaged. Contract farming appears to be a useful tool in this respect. Such an instrument once exercised fairly will guarantee markets for the farmers and will serve to discipline them in their approach to farming with the expected results of both improved yields and quality, while it would guarantee the potential millers a ready and steady supply. Further to this, investment in mills of the type envisaged for Cluster 2, as mentioned in recommendation 2 below, which will fuel increased use in the feed and starch industry will have a positive influence on yields in areas particularly in Cluster 2, which assumedly will supply these mills.

[10] AMCAR/Mainstay organic pineapple processing facility in Region 2 (Pomeroon-Supenaam).

Resulting from the dissection of the observations made above, the following specific recommendations are proposed as it regards the actual and potential market for cassava in Guyana:

1. The creation and/or strengthening of farmers' marketing organizations with the mandate of marketing the collective output of farmers in its organization and through which prices and quantities are negotiated with purchasers. Such an arrangement will create the incentive for farmers to expand cultivation and take the necessary measures to improve yields as a result of more stable markets and improved prices. While this is more specific to Cluster 2, it may also be relevant for Cluster 1.

2. The establishment of cassava processing plants, either through community-type undertakings, private undertakings or private-community type commercial partnerships in the locale of both clusters catering to specific products. Products such as starches, feed, cassava flour to be used as composite with wheaten flour, bio-fuel and other traditional food preparations. The larger manufacturing/industrial centres that are to be found in Cluster 2 can possibly concentrate on starches, cassava flour to be used for composite flour, and livestock feed (particularly poultry), while the traditional food preparations such as farine, casareep, as well as bio-fuel which can be used to generate electricity for small communities, can be the focus in Cluster 1. It is envisaged that such processed products can be sold to miners in the mining communities and in the case of bio-fuel, such an operation can be community operated. Livestock feed can possibly be included in Cluster 1 as well.

3. The introduction of contract farming can serve as an important tool in creating the kinds of structures and requirements necessary for the development of a viable and authentic value chain for the local cassava sector. The expanded production scales of cassava-processing plants particularly can be served positively through contractual arrangements with farmers in order to support their increased demand. It is envisaged therefore, that such an arrangement would provide immense benefits for farmers in the form of reduced price risk as prices are specified in advance, and the possibilities of provision of inputs on credit from the mills and transfer of technology and new skills which ultimately may help in improving yields. Further, the concern of inadequate access to formalized production credit for farmers would be significantly reduced through the possible provision of production inputs by mills on credit to

farmers. As it regards the potential advantages that can be derived for the cassava mills as described in the second recommendation, supplies would be more reliable than open-market purchases and more consistent quality can be obtained than if purchases were made on the open market.

Despite its relatively limited scope, and its focus on seven of the ten administrative regions of Guyana, this study has offered a perspective on the actual and potential market for cassava in Guyana. Particular attention was devoted to selecting a randomized and highly representative sample. The propositions recommended as interventions/strategies in addressing the undeveloped state of the cassava value chain would need to be refined through more rigorous financial cost-benefit analyses, and possibly economic cost-benefit analyses, since some of these propositions have implications for food security particularly in areas where cassava and cassava based products are the staple.

APPENDIX 1

Actual and Potential Market for Cassava in Guyana

QUESTIONNAIRE

GENERAL INFORMATION

1 Region #
2 Farmer's Serial Number
3 Data Collection Date
4 Data Collection Officer

FARMLAND USAGE

5 Total Area of Farm (Acres)?
6 Total Area of Farm Presently under Cassava Cultivation (Acres)?
7 Total Area of Farm Normally Cultivated with Cassava (Acres)?
8 Tenure:

- Owned through Title ☐
- Leased ☐
- Squatting ☐
- Informal Arrangement ☐

PRODUCTION, CONSUMPTION AND MARKET DATA

9 Main Type of Cassava Cultivated?

- Sweet ☐
- Bitter ☐

10 Normal Cassava Output?
11 Expected Cassava Output?
12 Main Reason for Difference from Normal Cassava Output:

- Pest Infestation ☐
- Poor Weather ☐
- Other ☐

13 Percentage of Output Consumed by Household?
14 Percentage of Output Sold on Market?
15 Main Reason for Difference Between Output and Household Consumption:

- Feed ☐
- Spoilage ☐

16 Where/ To Whom Cassava is Normally Sold:

- Processor ☐
- Wholesaler ☐
- Retailer ☐
- Consumers at Local Market ☐

17 Normal Price Cassava Sold at?

18 Expected Price Cassava to be Sold at?

19 Why Prices May Vary:

- Low Demand on Market □
- High Demand on Market □
- Low Supply on Market □
- High Supply on Market □

20 What are Your Plans in the near Future Regarding Cassava Cultivation?