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FOOD SAFETY AND VALUE ADDED
PRODUCTION AND MARKETING
OF TROPICAL CROPS

Title: A Proposal for Effective Technology Transfer

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A PROPOSAL FOR EFFECTIVE TECHNOLOGY TRANSFER

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ABSTRACT

The paper examines the performance of the agricultural sector over the 10 year period 1995-2004. Indicators suggest that investments in Agricultural Research and Development (used as a proxy for the quantum of technology generated) have had little impact on agricultural production. In this regard, an assumption is made that technology generated has neither been adequately transferred nor adopted. Within the above context a holistic model for effective technology generation has been presented. It is argued that effective technology generation is market driven technology is more likely to be transferred and adopted by agribusiness entities. To implement this process, strategic alliances should be forged in order to address resource limitations. The entire process requires leadership and co-ordination.

Keywords: Technology generation, Selective process, Added value products

1. INTRODUCTION

The desire for strong regional research must be interpreted within the context of the region's medium and long term goals and reflected within its medium and long term strategic development. Stated repeatedly, is the region's goal that the agricultural sector should not only be competitive and viable, but that it must be a credible contribution base for the sustainable alleviation of poverty. Further, that sustainable food security in the Commonwealth Caribbean must be achieved through strategic and effective research and development activities.

The region's principals have determined that this goal should be attained through the generation and transfer of technology and that the technology so generated and transferred be market driven. Additionally, the fulfilment of this goal requires a suitable and sustained infusion of resources that is consistent with the market driven dynamics of agri-food production technology. Bharat Jagdeo, 2005 (CARICOM Shadow Minister responsible for Agriculture), in a recent submission suggested that over the years, the required level of resources invested in the region's agricultural development have neither been suitable nor consistent.

Additionally, the quantum of resources available to the region's R&D activities has disappointingly deteriorated in the face of declining real money value, frugal donor contributions and stakeholder indifference.

As a consequence the generation of technology products and services has been declining as critical resource input levels continued to be breached.

The investment of suitable levels of physical, human and financial resources accompanied by discernible returns to their utilisation are the pillars upon which an effective, structured and institutionalised regional R & D programme, might be rationalized and justified. The effort to generate and transfer technology in the absence of these inputs at the required level places unfathomable pressure on the execution of the institute's mandates.

One is left to ponder the impact of technology so developed not only with respect to the inadequacy of resources expended in its generation but within the context of an overall system including its identification, facilitation and adoption by agri-food industries.

It is within the backdrop of the above discussions that the following model for the generation of effective technology in agri-food production is presented.

2. METHODOLOGY

2.1 Structure of Presentation

The paper discusses a holistic model that could improve the effectiveness/impact of generated technology. The objective of the paper is to propose a model for accelerating the thrust of

agricultural development and increasing its impact on the overall welfare of the region's people.

It is suggested that effective technology generation is, by extension, technology effectively transferred and adopted.

Earlier rationalisations for the institutionalising of technology generation in the Caribbean, appeared founded upon the assumption that what was chiefly necessary for industries in the agricultural sector to become viable (and consequently for entrepreneurial incomes to escalate) was an increase in farm firm productivity. In the event, the process between primary production and income generation reflected a plethora of functionally related but uncoordinated components including public sector and producer consultations, field/laboratory research, education/training etc. Much has since passed and new visions accompanied by the realities of the interconnectedness of the latter are in vogue. Unanswered and unimplemented, however, is the level and intensity of the focused co-ordination needed to guide the selective process that must essentially precede effective technology generation.

An essential antecedent to effective technology generation is strategic market research as this activity guarantees the link between the consumer and producer of technology products and services. But while this link is necessary it is insufficient to guarantee technology transfer and adoption. Other critical elements include the availability of investment resources (in enterprise and continued research), government policy (affecting the availability of resources, exports, imports etc), sector management and organisation. For this reason it is argued the true role and responsibility of institutionalised research is the strategic linkage of all the players and processes that inform the demand for technology, influence its appropriateness, timeliness of delivery and its overall utility. The paper examines the performance of the agricultural sector, on the basis of which, a case for a new/holistic approach to technology generation is proposed. In order to lend objectivity to the above argument and support the overall analysis a selection of key elements associated with effective technology have been identified. These elements are functionally expressed as follows:

$$Y = f(D_{g\&s}, T_{g\&a}, I, E, G)$$

Where:

Y = Agribusiness incomes

$D_{g\&s}$ = the quantum & quality of demand for goods services

$T_{g\&a}$ = The level of technology generated and transferred

I = The quantum of investment in agribusiness (determined by the price of inputs, the availability of credit)

E = Entrepreneurial skills. Including. the ability to be competitive/ understand global trends, make good decisions

G = Government policy

However, given time and resource limitations as well as the status of the regional information system the variables selected for the analysis of the Caribbean Commonwealth's agricultural performance were as follows:

- a) The level of Agricultural Research and Development (AR&D): Where the level of AR&D (estimated by the investment of financial resources by stakeholders) is used as a proxy for the quantum of technology generated.

The analysis required the level of AR&D each year over 10 years in selected CARICOM countries. Since these data were not easily obtainable, the budget of the Caribbean Agricultural Research & Development Institute (CARDI) in each of the selected countries (which comprised mainly stakeholder subventions but included donor/collaborator contributions) was used to estimate AR&D investment in each country each year between 1995/2004. The AR&D budget involved expenditure in market research & development, biological research and associated professional/support services.

- b) The level of commercial investment in agriculture in CARICOM countries. The national agricultural commercial loan portfolio is used to estimate investment in agribusiness's. This information is used as an indicator of technology adoption (by agricultural producers) in order to boost their production. Based on data limitations, four sample countries were used. In this regard, investments were obtained from the data base of the respective Central Bank's.

- c) The level of total production estimated by the annual quantity of production in corresponding selected countries for selected non-traditional agricultural commodities. The same commodities (selected for their commonality and relative importance across the nine selected CARICOM countries) were utilised throughout in the estimation of production, imports and exports. The commodities selected were as follows:

Yam	Mutton
Maize	Mango
Cassava	Chevron
Cow pea	Papaya
Sweet potato	Milk
Hot pepper	

- d) The level of imports estimated by the quantity of selected agricultural imported commodities in corresponding selected countries
- e) The level of exports estimated by the quantity of selected agricultural food exports in corresponding selected countries

Data in respect of each of the above variables were assembled over a period of ten years between 1995 and 2004.

The data were used to determine the level and trend of investment in ARD with the respective levels of production, exports as well as investments in agribusiness and on the basis of these observations to present a strategy for institutional AR&D in its model for generating effective technology.

2.2 Estimation of Data

Owing to the (sometimes) unavailability, inconsistency and anomalies in the data-base a number of assumptions were made to satisfy the data gaps. In this regard, annual AR&D was computed as follows:

Computation of Annual AR&D

The data required were the annual AR&D budget in CARICOM countries each year for the last 10 years. Only data for one year (2005) in this regard were collected. Moreover the exact allocation to AR&D was not provided in all cases. To address this difficulty the annual CARDI budget for each country over the last ten

years was used as base data upon which calculations were used. The following notes/assumptions accompanied the calculations:

The CARDI budget was accumulated from allocations within the AR&D budget of each country

The CARDI budget could be expressed as a percentage of the national AR&D budgets

The CARDI budget in each country was complemented by donor and collaborator support funds

Within the context of the above note and assumptions, the following formula was used:

$$R_n / C = A_n$$

Where:

R_n = The annual CARDI budget each year for the last ten years

C = The CARDI budget for 2005 expressed as a percentage of each country's AR&D budget for 2005

A_n = The estimated annual AR&D budget for each country each year over the last 10 years

Each country's estimated annual budget is accumulated to provide the total AR&D budget for the region (9 selected countries) each year.

3. PRESENTATION OF DATA

Data assembled include nine selected CARICOM countries which are further divided into two groups based purely on the availability and classification of the data their and data base respectively.

The first category (Table 1) groups Trinidad & Tobago, Barbados, Jamaica and Belize. Four variables identified/estimated (between 1995-2005) were as follows:

Total annual agribusiness investment portfolio
Total annual AR&D budget

Total annual production of non-traditional commodities
Total annual exports and imports or a similar selection of non-traditional commodities

Table 1: Comparison of Responses to Agricultural Investment in four CARICOM Countries (Belize, Jamaica, Barbados, Trinidad and Tobago)

YEAR	INVESTMENT IN AGRICULTURE (US\$)		SELECTED AGRICULTURAL:		
	COMMERCIAL LOANS	RESEARCH & DEVELOPMENT	PRODUCTION (MT)	IMPORTS (MT)	EXPORTS (MT)
1995	8467	71311182	402847	306757	21980
1996	129579	63307244	427072	289642	23530
1997	148018	87410624	370133	318457	22264
1998	151057	64809982	362172	320276	20168
1999	136434	54353307	351012	258643	20832
2000	111632	47248600	289378	305291	18230
2001	117219	19591401	308835	287921	21026
2002	135174	18434842	298514	347927	26168
2003	119947	15727905	311214	286821	33159
2004	103677	19578679	313208	382213	39766

Sources: * Respective Central banks; + Ministries of Agriculture & CARDI
FAO, Ministries of Agriculture, Central Statistical Office

From the data tabulated above, the following observations may be made:

- § Commercial financing of agribusinesses has generally been declining in the above sample countries
- § Investment in AR&D has been declining
- § Apart from slight increases in 2003 and 2004, agricultural production has generally been declining
- § Imports of agricultural fresh produce have generally fluctuated
- § Exports of fresh produce have increased over the period 2000-2004

The second category (Table: 2) summarises production of similar selected commodities along with imports and exports but excludes commercial loans.

Table 2: Comparison of Responses to Agricultural Investment in Nine CARICOM Countries (Belize, Jamaica, Barbados, Trinidad & Tobago, St. Lucia, Antigua & Barbuda, Dominica, St Vincent & the Grenadines)

YEAR	SELECTED AGRICULTURAL:			
	RESEARCH & DEVELOPMENT (US\$)	PRODUCTION (MT)	IMPORTS (MT)	EXPORTS (MT)
1995	79449836	519959	313282	25385
1996	74627607	568267	300388	27139
1997	92130688	513652	325920	25716
1998	75222535	516090	325970	24056
1999	65830976	484297	265119	26020
2000	57156850	424345	320132	20887
2001	30001669	475099	303786	24482
2002	29776241	449575	381087	29318
2003	27062230	463086	300761	36420
2004	28055332	467548	390509	42529

Sources: + Ministries of Agriculture & CARDI; # FAO & Ministries of Agriculture, Central Statistical Office

From the data tabulated above, the following observations may be made:

- Investment in AR&D has been declining
- Apart from slight increases in 2003 and 2004, agricultural production has generally been declining
- Imports of agricultural fresh produce have generally fluctuated
- Exports of fresh produce have increased over the period 2000-2004

4. ANALYSIS & DISCUSSION

The data (Section 3) indicate that in general regional production of primary agri-food products has not risen to the challenges of global demands. In particular, regional agricultural production must significantly increase in order to service growing regional and overseas markets, promote welfare gains and increase producer incomes. Given limited resources this (increase) must understandably be attained through increased productivity forged by the availability and adoption of improved technology. But the data suggest that the supply response to investments in AR&D have not been positively skewed. For example, between 1995 and 2000 when AR&D investment fluctuated within a relatively higher scale, agricultural production steadily declined. A similar decline trend was observed in the commercial loan portfolio over the same period. Ironically during the period of continued decline in commercial agricultural loan and AR&D investment portfolios respectively, some slight increase in agricultural output was recorded. Given the observation over the entire ten-year period, there is little evidence that investment in AR&D (and consequently the generation of technology) has actually had a positive impact on agricultural output (and, indeed, agribusiness investment).

Additionally, the data reveal that in spite of a general decline in output over the period, the quantum of exports has generally increased over the corresponding period. This suggests firstly that export opportunities exist for agricultural products. Secondly, that rather than take advantage of these opportunities by expanding output, producers appear to have diverted supplies from domestic to export markets. One likely reason for this action might be the superior price differential in favour of export markets. It is possible that a strategic process (of which AR& D investment is an important part) must prompt the desired impact of available technology on agricultural output. Moreover that the sequential steps therein should commence with an acute understanding of the consumer and should include an astute understanding of the producer and his/her environment in its entirety.

4.1 Effective Technology Generation

4.1.2 Market research

The technology generation process must be initiated through strategic research. The output of this effort would be the ability of those who hold the mantle of technology generation to identify, characterise and classify the needs of those whom the benefits of technology products must ultimately target. The execution of these activities fall within the rubric of market research. Good market research must guide the researcher to a product in its nearest and most preferred consumable form. For example market driven research must start with the quantification and qualification of the demand for pepper sauce rather than pepper, orange juice rather than fresh orange, convenience/ready to cook packs rather than uncleaned, unpeeled, uncut crops/meats etc. There is an intricate link between primary and processed products. It is suggested that the generation of technology in the production of primary agricultural products must be essentially influenced by the consumption of processed products. The market researcher may facilitate this process through direct linkage with the consumer (of agri-food products) or indirectly through the processor. For this reason effective technology generation must commence with an efficient consultation process including consumer and processor (Figure 1); the output of an efficient consultation process is a well designed technology generation plan which is very likely to deliver the technology products that would satisfy consumers' demand. Ideally the entire process of technology transfer must be essentially seen as components of the same system.



Figure 1: Model for the effective generation of technology

Consequently such technology products would be more easily transferred and adopted. Since the demand for consumer/added value goods must drive the production of agricultural technology products and services then all aspects of agri-food products (including product development & innovativeness, promotion) must be included in the portfolio of the agricultural research function.

4.1.3 Technology generation

In the generation of technology it is essential that the appropriate quantum of resources be mobilised and managed. Not only are resources limited they are typically/increasingly unable to match changing global/consumer demands for new competitively produced products. In this regard the business of technology generation needs to be facilitated through strategic partnerships, efficient networking and all such activities which involve the sharing of resources to attain a common goal. Accordingly, opportunities to forge strategic alliances must be continuously explored as the general evidence is that financial investment by traditional stakeholders in agricultural research is declining. This decline in AR&D investment is supported by the data provided in Tables 1 & 2 above.

However based on the level of subjectivity linked to its (AR&D investment) compilation, much work has to be done if unequivocal conclusions can be drawn in this regard. For one thing it was not possible to confirm the full composition of the AR&D budgets provided by any of the countries. Indeed, expenditure on traditional crops, fisheries and forestry which might have been included in these budgets could not have been easily separated. Additionally, the CARDI AR&D budget itself which was used as base data, being actual expenditure would have reflected its own declining stakeholder contributions and irregular servicing of arrears. Moreover undetermined lags exist between the timing of AR&D investments and the subsequent generation of technology on the one hand and corresponding changes in agricultural production on the other. Be that as it may, from the data provided one might infer a generally declining trend in AR&D investments that should be reasonably consistent with other sources of information. This trend of decline in agricultural investment within the region is reported by Little (2004) over a similar period. As a consequence, no statistical correlations between AR&D and estimated agricultural performance indicators were attempted.

The model presented (Figure 1) refers to and identifies a sample of collaborative options that

must be employed in the generation of technology, and the improvement of agribusiness incomes through increased production and productivity.

Additionally, given global demands, trends and changes (climatic, nutritional, geopolitical) model may be useful to the focus of research for technology generation. For example, should research be basic or applied, how should this be skewed? How could regional research influence positive changes in agricultural production through improved technology. Based on the above data there is little evidence that the collective research effort of the region has had a strong impact on agricultural production. However much more work has to be done before the reasons for decreasing production levels could be suitably qualified. Indeed apart from the availability of appropriate technology, a myriad of factors (including climate, global competitiveness, labour supply affected by competing sectors, limited financial resources etc) are known to affect regional agricultural production. Certainly, if all the technology generated were effectively transferred and adopted it would be easier to isolate the major factors which contribute to production indifference.

4.1.3 Technology Transfer and adoption

The adoption of technology is an important part of the feed back process, and feed back is a critical in the overall continuum of effective technology generation.

Unfortunately, within the region there is a myriad of technology products that have either only been transferred or transferred but not adopted. It is the author's submission that if technology is not adopted it could not be described as effectively generated. Further untransferred technology is likely to be as much a victim of ineffective pre-emptive market research as is ineffective technology transfer methodologies and systems.

One precondition for efficient technology transfer is the understanding of the role of the extension system as the principal transfer agent and agribusiness entities (the targeted beneficiaries). Since the targeted beneficiaries are indeed agri-business entities (and assuming agri-business entities are profit maximising) then

Networking

Information management

it is suggested that the objective of the extension service is to increase farmers/agribusiness incomes. To reflect this role, one suggestion has been the replacement of the title 'Extension Officers' with the title 'Enterprise Development Officers'. This would mean additional training in areas of accounting & finance, project development, farm management etc. without diluting the more traditional areas of expertise in education, rural development, communication etc.

To be sure, a different/business approach to the execution of extension services would be required, albeit within the tried and tested framework-work of extension methodologies and approaches summarised as follows:

Training and visit

On-Farm Demonstration

Demonstration & Training Centre (DTC) or Extension Outreach Centre (SKN)

Farmers'/Producers' meetings

Production of educational materials

Mass media techniques

Farmer field schools

Use of information and communication technologies

Shift in focus from 'technology only' to examine human and behavioural aspects

Emphasis on the importance of people's participation in strategic planning, management; field implementation of agricultural extension, training programmes and technology transfer

Needs based and demand driven

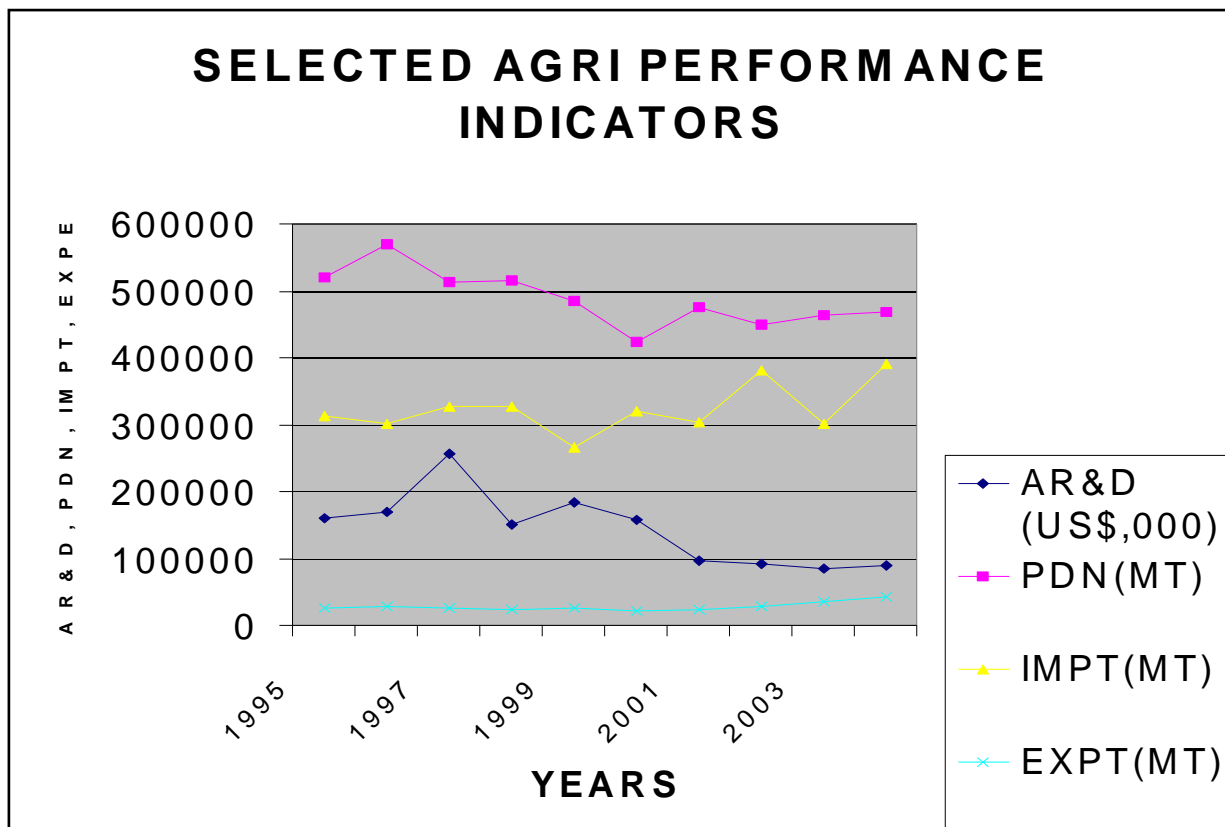
As shown, extension methodologies and approaches have become increasingly participatory as well as holistic but must essentially be delivered within a business mode. This requires a greater range skills (apart from those required) by extension agents including **inter alia**:

Project development

Marketing

Business development

In addition to those already required the above skills must be added to the broad spectrum of expertise required within the extension function.



It is suggested that this is necessary to ensure that technology generated is effectively transferred to and adopted by the targeted beneficiaries. It is the adoption (not generation or transfer) of technologies by agribusiness entities that increase the probability of increased production, and sustainable financial viability. For example, a review of the recently concluded European funded CARTF (Carriforum Research & Training Fund) reveals that, of the estimated US\$4.2m expended many service providers have reported that very few beneficiaries have actually adopted the technology obtained. Additionally, this adoption process must be facilitated by the physical (e.g. equipment, infrastructure) and services portfolio (e.g. marketing, financing, technical assistance etc.). In general, there has been little evidence that the above processes (including technology

generation, extension support, services and infrastructure) have significantly contributed to the performance of the agricultural sector. Indeed, illustrations in **Figure 2**

Figure 2: Display of agricultural performance indicators

Where:

Production, imports and exports are expressed in Metric Tonnes

AR&D investments expressed in US\$000. Only displays the decreasing trend of AR&D in the region reveal a disappointing mosaic of declining investments (in commerce and research), declining production, and increasing imports over the last ten years. A similar declining trend is observed in respect of commercial bank loans (**Figure 3**), shown separately to accommodate scale.

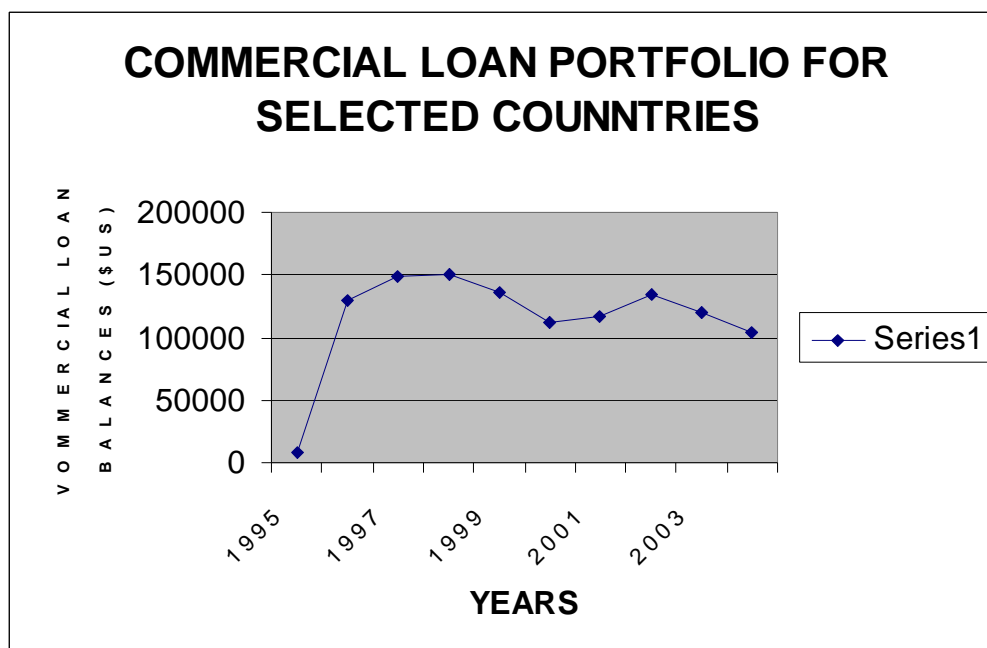


Figure 3: Trend of agricultural commercial loan balances in selected countries

Although the available data are not detailed enough to support an efficient analysis of the indicated trend of agricultural performance, a few conclusive remarks might be made as follows:

1. Significant investments have been made in AR&D (albeit in a declining trend) from which one could infer that some technology (however limited) must have been generated
2. There is little evidence to suggest that the technology generated has been transferred and adopted
3. Agricultural production (estimated by the annual quantum of a selected basket of commodities produced) over the corresponding period has in general been declining.
4. The declining annual trend of the agricultural commercial loan portfolio does not convey confidence in the sector

As stated earlier, a myriad of factors could contribute to the steady decline of agricultural production. However, based on known experiences (e.g. CARTF), discussions with knowledgeable personnel and the above data the use of obsolete or ineffective technology is likely to have a significant impact on the

observed declining trend. There are two probable fundamental reasons why available

technology may not have been adopted. Firstly it might not have been appropriate and secondly financial limitations.

It is for this reason that the effort to generate technology must be strategic/market driven. Moreover this technology must effectively transferred through the application of efficient transfer/extension methodologies; this process should be promoted through strategic alliances including all components of the agri-food chain (e.g. the processors, educators, producers, financing institutions, researchers etc)

4.1.4 Completing the Cycle

An important aspect of the technology generation model (Figure 1) is feedback from technology users/agribusiness entities into the market intelligence system as this ensures continuity of the process. For a number of reasons, agribusiness entities (whether farmer or processor) are critical sources from which information that could help define the technology products demanded, might be obtained. For one thing, as the producer of primary products, the farming entity gets first bite of the technology generated and can quickly determine its proximity/appropriateness to the specified market characteristics. In this capacity, the farming entity is itself a consumer, and being

higher up the commodity chain is the first consumer of technology products generated. On the other hand, apart from its linkage with the research institution, the farming entity has a direct link to the market for primary products. This is a complex market comprising not only

food processors but also consumers of primary products in its unprocessed as well as processed forms (Figure 3). This market is often well segmented and the farming entity must meet its challenges in order to survive and maintain commercial viability.

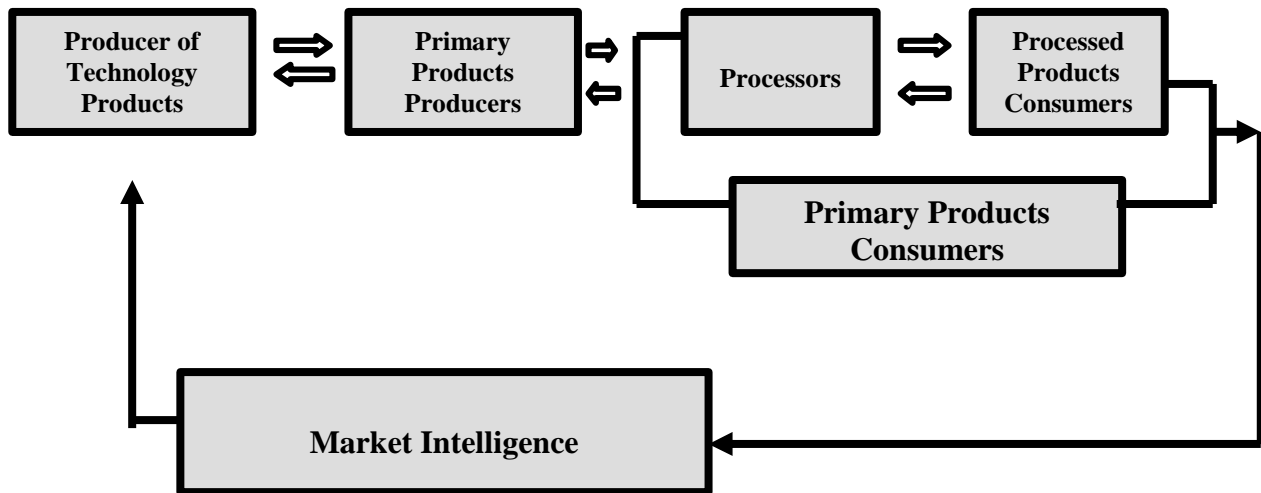


Figure 3: Information Flows between Producers and Consumers

Figure 3: Information flows between producers & consumers

As a producer of processed products, the processor has a two-way link between primary producer and agri-food consumer. In this regard the processor expects/demands from the farming entity the type of primary products that could be used to reflect consumer preferences. In this capacity, processors often direct the pace and characteristics of the primary production process as they (processors) are a key conduit through which the agri-food market speaks.

Both processor and primary producer are input components of the early market intelligence process and essentially, collectively, guide/inform the initial generation of technology. However, since the market is dynamic their collective role as part of the feedback process is critical, and the researcher must find ways to maintain that feedback linkage. One example of the significance of their role in technology generation is the case of hot-pepper production. In this case, the market which demanded West Indies Red (light green before it changed to red in its ripened stage), a variety produced by CARDI was exported in its green mature (light green stage) and often appeared in fruit & vegetable stores in that (light green) colour before ripening. A significant segment of the market shifted its preference to a dark green pepper even though it still ripened red. The institute responded by producing the CARDI Green in order to maintain the competitiveness of its clients. The intelligence supporting the significance of the market shift was gathered through feedback from agribusiness entities which had earlier adopted the West Indies Red.

5. LIMITATIONS OF THE PAPER

Undoubtedly, the principal and most basic limitation of the paper is the unavailability of data both at the national and regional levels. In each case even when data were available numerous (often too many subjective) measures have to be carried out in order to convert the data to usable information. This has grave implications for decision making both from historical and future perspectives.

6. CONCLUSIONS

The entire process (Figure 2) is presented as the model for a holistic approach to the effective generation of technology. By extension, the model is in fact a functional representation of the players and their probable roles within the agricultural sector. Key players include *inter alia*, market intelligence/development agencies (e.g. National marketing boards) agencies of higher education (e.g. Universities), Technology generation agencies (e.g. national & regional research), technology transfer agencies (e.g. extension services) and financing agencies (e.g. development banks). Within the context of the model, the collective services provided by the above agencies are required in the generation, transfer and adoption of technology. Further, that the technology should increase production and productivity in the agricultural sector and improve the lives/wellbeing of its clients. This is the process of 'Effective Technology Generation'. How should this process be driven? To be sure the process could only be driven through the forging of strategic partnerships amongst players within the agricultural sector and other players through inter-sector linkages in general and in particular, the tourism and manufacturing sectors. The data presented (Section 3), suggests that there is disappointing indifference between technology generation and the production of primary agri-food products. In order to redress this effect, the entire process of effective technology generation must be co-ordinated and strategically driven, who must lead/drive the process?. Whoever drives the process and those to whom the function of effective technology generation is charged could no longer allow fate to influence the direction and effectiveness of their efforts and should be on standby to take the mantle of leadership the sector demands.

7. RECOMMENDATIONS

Within the context of the recommendations made, there are two broad considerations. Firstly the opportunities for further work need to be explored. Secondly the role of

CAES as a regional professional association must be evaluated.

In terms of the former, it is very clear that apart from the availability of technology, a myriad of variables have an impact on agricultural production and productivity. Although value could be ascribed to most, many of these variables could only be subjectively quantified. In this regard the following are recommended:

1. The establishment of a credible regional data base in which data is classified in numerous forms for numerous uses. This process can be advised by a regional team including economists and statisticians.
2. Studies/dissertations could be conducted through which the statistical analysis of relationships of variables within the agricultural sector is carried out at regional levels using data drawn from improved national primary and secondary data bases.

In terms of the role of the CAES, the following is recommended:

3. Through national CAES chapters, the CAES should organise itself to provide advisory support services to entities including development banks, the Caribbean Agribusiness Associations (CABA), MOA's in the area of policy formulation

In terms of strategic considerations:

4. The adoption of a holistic approach by research agencies to the generation of technology.
5. The forging of strategic alliances in order to address resource limitations associated with technology generation.
6. Establishment of centralised regional system to provide co-ordination/leadership in the generation of effective technology.
7. A strategic shift of the extension services objective increasing farmers' incomes.

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