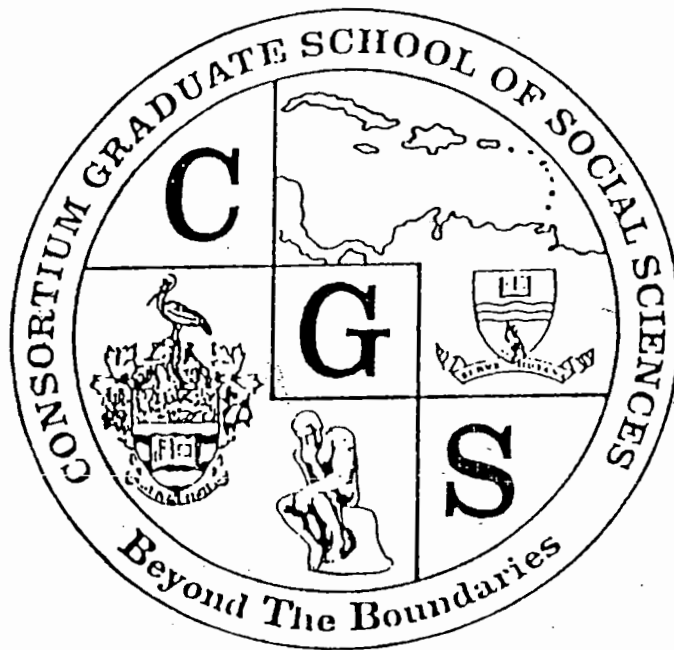
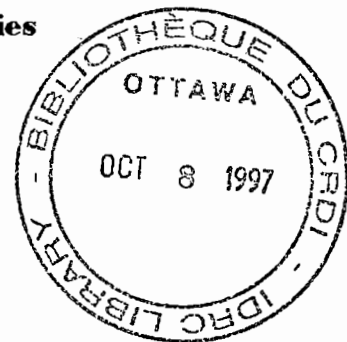


**ISSUES IN CARIBBEAN DEVELOPMENT:
A COLLECTION OF RESEARCH PAPERS**

VOLUME I Nos. 1-5



**M.Sc. in Development Studies
1993**



Consortium Graduate School of Social Sciences

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FOREWORD

This publication is a collection, in two volumes, of research papers submitted by the 1991-1993 class of students of the Consortium Graduate School of Social Sciences, in partial fulfillment of requirements for the award of the M.Sc. in Development Studies degree: the original papers have been minimally edited. The papers cover a variety of issues in Caribbean development, ranging from tourism and export promotion, agricultural development and sugar production, to self-employment and craft production, privatisation, technology and education, and application of information technology. The Consortium Graduate School of Social Sciences is a policy-oriented, interdisciplinary, joint programme of the University of the West Indies and the University of Guyana, located at the Mona Campus of the University of the West Indies. The School also offers the MPhil and PhD degrees.

ALL ROSTER



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**SEX DIFFERENCES IN RESPONSE TO GENERAL CERTIFICATE OF
EDUCATION AND CARIBBEAN EXAMINATIONS COUNCIL COURSES IN
COMPUTER STUDIES: A CASE STUDY OF JAMAICAN HIGH SCHOOLS**

**A Research Paper
Submitted in Partial Fulfilment of the Requirements for the
Degree of Master of Science in Development Studies**

**of
The University of the West Indies**

**Brian Alleyne
(91-165635)
1993**

**Consortium Graduate School of Social Sciences
Faculty of Social Sciences
Mona**

ABSTRACT

Sex Differences in response to General Certificate of Education and Caribbean Examinations Council Courses in Computer Studies: A Case Study of Jamaican High Schools

Brian Alleyne

This research paper examines the responses of students in three Jamaican schools to courses in computer studies which lead to examinations of the Cambridge General Certificate of Education and Caribbean Examinations Council.

Existing work on different approaches to epistemology and cognitive style, and different styles of computer usage, was reviewed. An attempt was made to conceptualise a continuum of styles of computer usage which ranges from abstract and formal on the one hand, to concrete on the other, and to develop a scale which could be used to measure this range. The study employed a questionnaire and a standard test of cognitive style as its main data gathering instruments. Teachers of computer studies in each of the three schools were interviewed.

No statistically significant sex differences were found. The sample was of a non-random type and as such, no generalisations were attempted. The two syllabi were compared and both were found to favour an abstract approach to computer usage. While some of the items in the scale of computer usage styles were found to be significantly correlated with each other, the scale as a whole was not found to be internally consistent. Several factors identified in the literature were found, which restrict student access to computer studies as a subject choice.

The study concluded that while no sex differences were found for the sample, this could not be used as a basis for generalisation to the wider school population. It was recommended that further work be done, both in Jamaica and regionally, and that particular attention should be paid to the factors which were found to restrict access to computer studies.

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Brian Alleyne

June, 1993

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SECTION 1

INTRODUCTION

1.1 Research Problem

This study explores and evaluates opinions and reactions of male and female secondary school students to the Caribbean Examinations Council (CXC) and General Certificate of Education (GCE) Ordinary level Computer Studies courses of training. For the purpose of the study, the course of training will be considered to consist of the teacher, textbook(s), syllabus and physical facilities which are provided by a given school to train students for the GCE and CXC Computer Studies examinations. In addition, the study makes preliminary attempts to develop a scale which can be used to identify differences in computing style amongst secondary school students.

Gender is an important analytical category in this research as the literature emanating from North America and Western Europe found that females tend to respond more negatively to, and appear to benefit less from, computer studies programmes than do males (Badagliacco, 1990; Collis, 1990; Kramer and Lehman, 1990; Papert and Turkle, 1990).

This literature suggests that males and females respond differently to computer studies training and that this may be due to several factors: different cognitive styles; different expectations on the part of instructors as to aptitude of males and females; and differential constitution of the male and female computer studies student, in the learning environment and in instructional texts and software manuals.

The study will seek to make theoretical and empirical links between the following concepts: field independence and formal, abstract approaches to computing on the one hand; and, field dependence and concrete approaches to computing (bricolage)¹, on the other. In addition, evidence will be adduced to show that a formal, abstract approach to creative work has, historically, been socially constructed as male, and valorised, while a concrete approach has been socially constructed as female (and "primitive") and devalued. It will further be argued

¹ These concepts are fully discussed in the literature review.

that this discourse of asymmetrically valued epistemological approaches has been constructed by European, bourgeois males to serve their own interests (Edwards, 1990; Harding, 1987; Shiva, 1989; Stanley, 1990).

1.2 Research Questions

The study employed the following research questions:

1. Do males and females have different cognitive styles as measured by the Group Embedded Figures Test²?
2. Does the set of items used to assess the computing style of the student constitute a valid measurement scale of computing style?
3. Do males and females respond differently to courses in computer studies?
4. Is cognitive style significantly related to responses to computer studies?
5. Do males and females have different approaches to working with computers?
6. Does the gender composition of the classroom: single sex male, single sex female or coeducational, relate to opinions expressed about computer studies courses?
7. Do teachers of computer studies have different expectations about the capabilities of males and females to acquire computer skills?

The following units of analysis were employed in the study:

Three secondary schools were selected; one single sex female, one single sex male and one co-educational. In each school, all students preparing for the CXC/GCE computer studies examinations in June, 1993, were interviewed. The syllabi for both examinations were analysed. The computer studies teacher in each of these three schools was interviewed. Available hardware and software were also considered.

² This is a standard psychological test of cognitive style.

1.3 The context

1.3.1 Global growth and impacts of information technology

The production of goods and services, public administration and the expansion of human knowledge are all increasingly dependent upon the application of computers, software engineering and telecommunications: which together constitute information technology.

Information technology has led to major economic restructuring in the advanced industrial countries. The sectors that dominated in the post war period are now falling behind those based around the new technologies. Countries find that they have new positions in the global economy: Britain and France give way to Japan as industrial powers, Germany becomes a major player (again) by adapting new technology to existing products. Smokestack industry declines while silicon valleys and glens spring up.

This technology can have radical social impacts. In The Third Wave, Alvin Toffler (1985) gives a fascinating account of the way information technology is changing the way people live and work in the advanced industrial countries. He points to a trend which suggests a return to cottage industrial production and to a more general trend of the home playing a larger role in peoples' lives than was the case at any other time in this century. For Toffler, post-industrial society would be increasingly decentralised, and characterised by what Piore and Sable (1984) refer to as flexible specialisation. Though Toffler's vision is an optimistic one, there is a darker side to this new technological paradigm: the grim visions of future societies as in George Orwell's 1984, where the totalitarian super-state - Big Brother - rules with the aid of these technologies, and Anthony Burgess' A Clockwork Orange, may serve as cautionary tales to planners, implementers and users of information technology.

Even if the dark prophecies of Orwell and Burgess do not come to pass, there remain nonetheless several disturbing implications of the diffusion of these new information technologies. Mark Poster (1990), working in a postmodernist theoretical framework inspired by the work of Michel Foucault (see Foucault, 1980 for a discussion), has suggested that just as the mode of production may have been the main analytical tool in understanding industrial society, in the emerging post-industrial society, what he calls the 'mode of information' may be key. This follows from the work of Foucault in which he explored the relations between knowledge and power. Poster asks us to consider that in the future those who control information

technology (and by implication, information) may hold the real power in society. The mutually reinforcing link between control over this new technology and power is relevant when the issue of existing gender relations is considered: information technology has to-date been seen as a male domain (Edwards, 1990; Cohn, 1987).

1.3.2 Is information technology needed in developing countries?

It would seem that the foreseen benefits of information technology outweigh the disadvantages, when looked at from the perspective of developing countries. M R Bhagavan, discussing the role which information technology plays in the modern service sector, has this to say:

All sections of society in a third world country are profoundly affected by modern service technology, whether or not they have the regular use of it, operate it and control it. There are two reasons for this: this technology plays a key role in generating, establishing and strengthening the process of integration of all systems of production with domestic and foreign markets; and the modern institutional and organizational forms used by private enterprise and by the state in almost all third world countries are modelled on those prevalent in developed capitalist and socialist countries³.

The implication of this is that information technology does indeed serve to deepen the integration of developing countries, including the Caribbean, into the global economy. The question which may then arise is: does it automatically follow that we will stand to gain in terms of development to the extent that we become increasingly integrated into the global economy?

David Hawkridge and colleagues, writing on computers in the third world context, offer the following justifications for investing resources in developing a computer capability:

Indeed, governments of developing countries can no longer escape considering computer, but their policy on computer, because it is controversial and expensive to implement, must be backed by an understanding of potential functions for

³ M R Bhagavan. The Technological Transformation of the Third World. London: Zed Books, 1990, p 62.

computers in integrating systems, improving problem-solving and analysis, improving management, developing natural resources, maintaining international communications and national competitiveness⁴.

From within the Caribbean itself, both McIntyre (1991) and Demas (1989) assert that we must strive to set up and maintain modern information technology infrastructure if we are to have any hope of competing in the global economy. The human resource needed to set up, maintain and ensure the functioning of this technology must be developed among the youth, and must include males as well as females.

1.3.3 Sex differences in secondary school achievement in Jamaica

Research carried out in Jamaica has found that females perform better than males in 13 of 27 secondary school-leaving examinations (Leo-Rhynie in Hart [ed], 1989). We note though, that in her broader discussion of gender differentials at different levels of the Jamaican education system, Leo-Rhynie is careful to show that gender inequality can and does impact negatively on males as well as females. The implication we draw from this is that we must be careful not to assume that gender inequality always acts to the advantage of males and consequent disadvantage of females, even though such is most often the case.

Errol Miller (1986) has shown that, in the 1970s and 1980s, females attained more places in Jamaican secondary schools than did men. He went on from this to put forward his thesis of marginalization of the black male, which remains a current topic of debate in Jamaica and has spread to other parts of the region.

These findings suggest that in a research project such as the present one, we would be best advised not to assume superior male performance, despite the North American findings. Indeed, a reading of Miller's work might lead us to hypothesise superior female performance in computer studies at the secondary school level.

At this point, we would do well to remind ourselves that this study is not looking at performance of male and female computer studies students, but rather is attempting to develop a test instrument to assess a concept of different computing styles, and to determine if males and

⁴ David Hawkrige et al, Computers in Third World Schools: Examples, Experience and Issues. London: Macmillan, 1990, p 8.

females respond differently to computer studies courses.

1.4 Rationale

This study is justified from both academic and policy perspectives. Firstly, as far as is known by the researcher, no research has been done in this field in the Caribbean region, so the findings could help to fill a gap in the existing literature.

Secondly, the study is justified on policy grounds. Information technology is a pivotal element in economic development both in the North and South. An ever increasing quantity of consumer and industrial goods as well as services, feature information technology in the form of microprocessors, software, telecommunications, or artificial intelligence. This family of technologies is adding ever more value to existing products and bringing new products into existence. Caribbean governments, generally, and the West Indian Commission, specifically, recognise the need to develop greater regional capability in information technology. A main element of any technological capability is the educational component. It is at the secondary school that the best opportunity exists to equip a wide cross-section of the regional population with information technology skills. The researcher argues, therefore, that a viable programme of training at the secondary school level should be a regional priority. In order to maximise returns on the scarce resources we invest in this area, we must ensure that all of our young people, boys and girls, derive full benefit from computer studies training. This requires that we identify, and minimise or eliminate any factors in our training programmes which would favour one sex over the other.

SECTION 2

LITERATURE REVIEW

2.1 Theoretical Overview:

The problematic of gender

The theoretical framework employed in this study is broadly feminist as outlined by Sandra Harding⁵. Such a framework sees gender as an irreducible social analytic category, like race or class. Of these three categories,

⁵ Sandra Harding, Feminism and Methodology. Milton Keynes, Open University Press, 1987.

none is reducible to the other: to subsume gender within the class question and treat it as subsidiary is a mistake of which the determinist variant of Marxism, for example, is guilty. Likewise, to treat gender as subsidiary to race, as was done in the heyday of the North American black nationalist movement⁶, is equally wrong-headed.

Harding admits that the binary categories of gender: masculine and feminine, are categories within race, class and culture, because men and women perceive themselves and each other differently depending on their positions within already existing race, class and cultural structures. At the same time, Harding asks us to consider that race, class and culture are also categories within gender, because men's and women's interests differ according to race, class and culture. Sexism does not manifest itself in a universal fashion⁷.

In addition to placing gender as a fundamental analytical category, this theoretical framework is social constructionist: it holds that these irreducible analytical categories of race, class, gender are not transcendentally given, but rather are situated in specific historical and social contexts. As such, this perspective holds that any differences between men and women which manifest themselves in the social sphere are the result of social construction and are not biologically given. This perspective conceptualises gender as a social category: the differences between masculine and feminine in any culture are socially constructed. The process whereby human beings come to acquire gendered identities ("gendering") is social.

This perspective seeks to ground itself in the actual experience of women:

A distinctive feature of feminist research is that it generates its problematics from the perspective of women's experience⁸.

2.2 Gendered epistemology

Epistemology is the branch of philosophy which addresses itself to theories of knowledge. Epistemology concerns itself with what counts as valid knowledge and

⁶ For a critique of the tendency to subsume gender beneath race see Angela Davis, Women, Race and Class (New York: Vintage, 1981).

⁷ Harding, op cit, p 7.

⁸ Ibid.

why, who can be a proper subject of knowledge and how we might assess competing truth-claims of different kinds of knowledge. According to Harding:

An epistemology is a theory of knowledge. It answers questions about who can be a "knower" (can women?); what tests beliefs must pass in order to be legitimated as knowledge (only tests against men's experiences and observations?); what kinds of things can be known (can "subjective truths" count as knowledge?), and so forth. Sociologists of knowledge characterize epistemologies as strategies for justifying beliefs: appeals to the authority of God, of custom and tradition, of "common sense", of observation, of reason, and of masculine authority are examples of familiar justificatory strategies⁹.

It is clear from the above passage that Harding sees gender as deeply imbricated in epistemology. Indeed, for Harding, epistemology is a site of struggle, a site dominated by androcentric notions of science and truth. For Harding, much of current epistemology displays gender bias in favour of white, Western, bourgeois males.

Another author who offers a critique of the androcentric nature of Western science is Vandana Shiva¹⁰. For Shiva, modern (Western) science became a patriarchal project from the time of Francis Bacon (1561 - 1626). This followed a period in the Middle Ages when women's knowledge came to be constituted as 'witchcraft' and many women were burnt at the stake in Western Europe. On Shiva's argument, the modern Western project of science is intimately linked to the (Western, bourgeois) male will to dominate the world, its resources and peoples:

Modern science was a consciously gendered, patriarchal activity. As nature came to be seen more like a woman to be raped, gender too was recreated...

Science and masculinity were associated in domination over nature and femininity, and the ideologies of science and gender reinforced each other¹¹.

⁹ Ibid, p 3.

¹⁰ Vandana Shiva, Staying Alive: Women, Ecology and Development. London: Zed Books, 1989.

¹¹ Ibid, pp 17 - 18.

Shiva links gendered Western science to the exploitation of women and non-Western peoples and she argues that the current economic and ecological crises facing the world can be laid squarely at the door of modern science. For Shiva, an alternative epistemology and ontology, based on what she calls the feminine principle - a cooperative view of the relationship between humans and nature - holds the best chance of overcoming the current crisis:

The parochial roots of science in patriarchy and in a particular class and culture have been concealed behind a claim to universality, and can be seen only through other traditions - of women and non-Western peoples¹².

The authors discussed here seem to be arguing for an alternative epistemology, one which could move beyond the androcentric assumptions which have grounded modern science, one which would allow space for women and non-Western peoples as valid subjects of science, as 'knowers' and contributors to the enterprise of knowledge creation and dissemination. Their call could be said to be one for epistemological pluralism.

2.3 Foundationalist and relativist approaches to epistemology

Harding's feminist standpoint can be said to be foundationalist in that it attempts to establish rational grounds on which a feminist epistemology can be based. This foundationalist position can be contrasted with a relativist position which is not so concerned to establish grounds for an epistemology. Indeed, relativists question the very notion of rational grounds in the first instance.

Jane Flax¹³ in an attempt to develop a theoretical and political articulation between feminist theory and postmodernist thought, finds much of value in Harding's arguments, but is wary of Harding's quest for a "successor science". Flax favours a relativist approach, for which postmodernist thought is best known, and it is this which leads her to argue:

As a type of postmodern philosophy, feminist theory reveals and contributes to the growing

¹² Ibid, p 21.

¹³ Jane Flax, "Postmodernism and Gender relations in Feminist Theory", Signs: Journal of Women in Culture and Society Vol 12, No 4, 1987.

uncertainty within Western intellectual circles about the appropriate grounding and methods for explaining and/or interpreting human experience¹⁴.

She wishes to problematise the foundations of science and knowledge, to deconstruct the taken-for-granted assumptions that underlie Western science, and she urges feminists to utilise the insights from postmodern theory in this regard:

Postmodern discourses are all "deconstructive" in that they seek to distance us from and make us skeptical about beliefs concerning truth, knowledge, power, the self, and language that are often taken for granted within and serve as legitimation for contemporary Western culture¹⁵.

A relativist position is also put forward by Stanley and Wise¹⁶. Like Flax, they suspect that foundationalist epistemology is incompatible with feminist praxis. They accuse Harding of practicing the very exclusion which is characteristic of androcentric science, when Harding dismisses the contributions of radical feminists as undertheorised. These two authors do not wish to build a feminist successor science, rather they argue for a plurality of political-intellectual positions. What would make such positions uniquely feminist, for them, can be gleaned by their conception of feminist theory, which is:

- theory derived from experience analytically entered into by enquiring feminists;
- continually subject to revision in the light of that experience;
- thus reflexive and self-reflexive and accessible to everyone (not just to theoreticians as a 'special' kind of person); and

¹⁴ Ibid, p 624.

¹⁵ Ibid.

¹⁶ Liz Stanley and Sue Wise, "Method, methodology and epistemology in feminist research processes", in Liz Stanley (ed) Feminist Praxis: Research, Theory and Epistemology in Feminist Sociology, London: Routledge, 1990.

kind of person); and

- certainly not to be treated as sacrosanct and enshrined in 'texts' to be endlessly pored over like chicken entrails¹⁷.

To summarise, it is our view that the tension between foundationalist and relativist epistemologies in feminist thought is a creative one. The foundationalist stance permits us to have scales against which to measure research and policy interventions, but runs the risk of dethroning androcentric science only to put in its place a successor science which might be as willing to exclude alternative knowledges as the antecedent science. The relativist stance allows space in which oppressed groups and knowledges can be articulated and is a welcome antidote to the arrogance of much Western science, but like all relativisms, it must contend with a profound paradox. That paradox inheres in the relativist assertion that there is no ultimate truth. As the assertion is uttered, it undercuts itself. On what grounds are relativist claims to knowledge (if not the truth) to be judged?

The overall feminist theoretical perspective and the different approaches to epistemology as developed by feminist theorists inform the present study in several ways. Firstly, they direct the researcher to treat with skepticism all claims about the essentially formal and abstract nature of computing as a discipline. Secondly, they furnish a language with which to speak and think about computing as a socially constructed, male-oriented activity. Thirdly, they furnish the researcher with a critical attitude to what constitutes proper knowledge and method in the discourse of computing.

2.4 Cognitive styles and field dependence/independence

The acceptance of epistemological pluralism suggests that different approaches to intellectual work may be valid when taken on their own terms. Psychologists have attempted to conceptualise what they see as different cognitive styles. One such attempt has resulted in the development of the concept of field dependence and field independence as a continuum along which individuals may be placed, and of a test instrument known as the Embedded Figures Test¹⁸. The Embedded Figures Test is:

¹⁷ Stanley and Wise in Feminist Praxis, op cit, p 24.

¹⁸ Herman A. Witkin et al, Manual for the Embedded Figures Test. California: Consulting Psychologists Press, 1971.

... a perceptual test. The subject's task on each trial is to locate a previously seen simple figure within the larger complex figure which has been so organized as to obscure or embed the sought-after simple figure¹⁹.

For Witkin and his colleagues, cognitive style is a collection of abilities which an individual employs to perceive and interact with the environment. Strategies for integrating sensory data with existing knowledge, identifying problems and solving these problems, and dealing with the interaction of the physical body with the physical environment, all employ cognitive strategies. Perception is the first step in interacting with the environment: the individual must perceive what is around her/him before deciding if and how to interact. For Witkin et al, individuals can differ in terms of their perceptual style, and they set out to develop a construct to study these perceptual styles:

The construct we applied to the style at issue here is "field-dependence-independence". In a field-dependent mode of perceiving, perception is strongly dominated by the overall organization of the surrounding field, and parts of the field are experienced as "fused". In a field-independent mode of perceiving, parts of the field are experienced as discrete from organized ground. Scores from any test of field dependence form a continuous distribution. Accordingly, the designations, "field dependent" and "field independent", like the designations, "tall" and "short", are relative²⁰.

According to these authors, consistent sex differences have been found in the field-dependence-independence dimension. Boys and men tend to be more field independent than girls and women. They cite studies in the United States, Western Europe and parts of Asia and Africa which support the sex-difference finding²¹. In addition, they claim that the evidence suggests that the sex difference may not be present below the age of eight and in geriatric groups. It is interesting that these authors do not go on to consider that this last finding may be suggestive of socialisation as a factor which may promote the sex differences in field-dependence-independence.

¹⁹ Ibid, p 3.

²⁰ Ibid, p 4.

²¹ Ibid, p 5.

The authors do note, however, that "field independent persons are not superior in "general" intelligence"²², and that both field independence and field dependence are advantages in specific situations.

This caveat notwithstanding, it seems that Witkin and his colleagues do somewhat privilege field independence over field dependence as a mode of perception:

Though a more field-independent mode of performing the EFT [Embedded Figures Test] is conceived as reflecting more developed cognitive functioning, it does not at all imply better adjustment or mental health²³.

We are not told why field-independence is "more developed cognitive functioning", and, in light of Harding's and Shiva's critique of science, one may well wonder if field-independence, which males are said to display to a greater extent than females, is not seen as more developed (cognitively), for ideological reasons. Is the cautious valorisation of field independence by Witkin and his colleagues not another example of gender bias?

Carolyn Wood Sherif²⁴ offers a critique of the methodology employed in psychology:

The methodology promoted in psychology, in its strivings for social acceptability and prestige, rested on the assumption that the causes of an event can be determined by breaking down the event into component parts, or elements, and studying those parts and their relationships to one another. The more "basic" these parts or elements are, the more "basic" is the inquiry.

This reductionist approach appears to be the one which informs the work of Witkin and his colleagues: the human being is constituted of various structural elements, one of which is "perceptual style", which can be isolated and studied in the form of a continuous variable: field-dependence-independence. This conception of the human being as an individual entity, a structure of discrete

²² Ibid, p 7.

²³ Ibid, p 10.

²⁴ Carolyn Wood Sherif, "Gender Bias in Psychology" in Sandra Harding, Feminism and Methodology, op cit.

psychological aspects amenable to experimental study is a contested one, according to Sherif. Further, Witkin et al appear too methodologically individualistic in their approach, when they refer to work that shows sex differences in field-dependence-independence across countries and at the same time confirm that these sex differences only manifest themselves after the age of eight. It appears that a problematic has been ignored here: the impact of socialisation on the development of gendered perceptions and resultant identities. Indeed, Witkin et al show no awareness of the gender problematic in their work.

The field-dependence-independence construct was employed in the present study with an awareness of these problems in its conception and application.

2.5 Gender differences in computing attitude and experiences in North America

Badagliacco²⁵ found significant differences in computing attitudes and experience between male and female college students in the United States. According to her findings, males were more confident of their ability to master the skills and knowledge of computing, and were also more likely to have had exposure to computing prior to entering college. Badagliacco did find, though, that women who choose to use computers have as favourable evaluative attitudes as men, and they do not find them any more dominating than men²⁶.

In a survey of grade 8 and grade 12 students in two British Columbia school districts in Canada, Betty Collis found:

1. Sex differences in attitudes toward computers are strongly established by grade eight.
2. Males are consistently more positive about using computers than are females, and more likely to express interest in and pleasure in using a computer.
3. Males and females agree that males are most likely to be computer users in their households, and that "mother" is the least likely person in their households to have any

²⁵ Joanne M. Badagliacco, "Gender and Race Differences in Computing Attitudes and Experience", Social Science Computer Review, Vol 8, No 1, Spring 1990.

²⁶ Ibid, pp 51 - 52.

interest in using a computer.

4. Females are more likely than males to associate social and academic stereotypes with computer users²⁷.

Collis seeks to explain these findings with a model comprising: school policies and practices; social expectations; and personal factors. Collis is critical of policies which set mathematics as a prerequisite for computer studies, which see the computer resources in a school as only or mainly intended for the teaching of computer studies and not for general support of the teaching project in other subject areas, and which place computers in the school computer laboratory which laboratory often becomes a male domain. She also criticizes social expectations which link computers with men and constitute computing as a masculine activity. She highlights personal factors such as low self-esteem in females which translates into lower expectations of computer ability than for males²⁸.

This is a fruitful conceptual model, in our view, and we shall utilise some of Collis' insights in the summary and conclusions of this research report.

2.6 Epistemological pluralism and the discourse of computing

The issue of cognitive style is relevant to the proposed research project. Leo-Rhynie (1978) found that among a sample of Jamaican A'level students, there were significant differences between Arts and Science students in cognitive reasoning, spatial ability and field dependence/independence. According to Leo-Rhynie, relatively field-independent persons are better at abstract reasoning, science and mathematics than relatively field dependent persons. Males tend to have higher scores of field independence than females. Leo-Rhynie cautions against placing higher value on field independence over field dependence: they represented extremes at either end of a ideal-typical continuum, one is not intrinsically 'better' than the other, only different.

²⁷ Betty Collis, "Adolescent Females and Computers: Real and Perceived Barriers" in Marianne G Ainley (ed), Despite the Odds: Essays on Canadian Women and Science, Montreal: Vehicule, 1990, (p 274).

²⁸ Ibid, pp 276 - 281.

Edwards (1990) argues that there are two distinct styles in using computers: a 'hard', rational style favoured by male practitioners, and a 'soft' more holistic style, employed by both male and female practitioners, but more so by females. This suggests that we may have to rethink notions about the background of a person likely to make a successful career in computing: traditionally it was held that persons with strong backgrounds in mathematics and sciences (such persons favour the 'hard', abstract, rational cognitive style) were most likely to achieve success in computing.

This conceptual framework is relevant to the proposed research because the abstract, formal style is closely associated with mathematics and related disciplines. As discussed earlier, there is a dominant view that mathematics ability is a good predictor of aptitude in computer studies: in the Caribbean as in North America, males perform better in mathematics than do females (Leo-Rhynie, 1978). It would follow from this, if we accept the relationship between ability in mathematics and aptitude in computing, that males can be expected to perform better than females in computer studies examinations. The possibility of a link between mathematics ability and computer aptitude is also explored by Kramer and Lehman (1990)²⁹.

Turkle and Papert (1990) employed the concept of epistemological pluralism in their study of the working methods of computer programmers:

The prevailing image of the computer represents it as a logical machine and computer programming as a technical, mathematical activity. Both the popular and technical culture have constructed computation as the ultimate embodiment of the abstract and formal. Yet the computer's intellectual personality has another side: our research finds diversity in the practice of computing that is denied by its social construction. When we looked closely at programmers in action we saw formal and abstract approaches; but we also saw highly successful programmers in relationships with their material that are more reminiscent of a painter than a

²⁹ Pamela Kramer and Sheila Lehman "Measuring Women: A Critique of Research on Computer Ability and Avoidance", Signs: Journal of Women in Culture and Society, Vol 16, no 1, 1990.

logician.³⁰

For these two authors, the highly formal, abstract approach to programming computers is a key element of a hegemonic discourse of computing which constructs the discipline as a mathematically-based discipline like physics or electrical engineering.

The abstract, formalized approach to programming is just one effective strategy, however, according to these authors. They contrast it with the conceptual approach of bricolage, originally put forward by the French anthropologist Claude Levi-Strauss. The person employing the bricolage approach is termed a "bricoleur":

Levi-Strauss used the term "bricolage" to contrast the analytic methodology of Western science with what he called a "science of the concrete" in primitive [sic] societies...[The] bricoleurs he describes do not move abstractly and hierarchically from axiom to theorem to corollary. Bricoleurs construct theories by arranging and rearranging, by negotiating and renegotiating with a set of well-known materials.³¹

These two authors see the abstract approach and bricolage (which they divest of Levi-Strauss's attempts to localize it culturally) as polar ends of a continuum: both concepts are ideal types (as are field dependence and field independence).

The possibility of a link between mathematics ability and computer aptitude is also explored by Kramer and Lehman (1990)³². They begin by pointing out a weakness in much existing research on sex differences in computing performance:

³⁰ Sherry Turkle and Seymour Papert, "Epistemological Pluralism: Styles and Voices Within the Computer Culture" Signs: Journal of Women in Culture and Society, Vol 16, no 1, 1990, p 128.

³¹ Ibid, pp 135-136.

³² Pamela Kramer and Sheila Lehman "Measuring Women: A Critique of Research on Computer Ability and Avoidance", Signs: Journal of Women in Culture and Society, Vol 16, no 1, 1990.

There is a large body of research documenting that sex differences in mathematics performance, where they exist at all, are based on complex interactions of social and attitudinal factors. Yet computer learning research that explains sex differences in performance in terms of males' superior performance in and exposure to high school mathematics may ignore this literature and explain any superior mathematics performance by males in terms of superior, quantitative, reasoning skills...

Some studies recognize that social or institutional factors play a role but then fail to question their assumptions about the relevance of mathematics ability to computer aptitude.³³

In their own work, these two authors abandon the decontextualized assumption of superior mathematics ability of males, as well as the supposed link between mathematics ability and computer aptitude. Instead they use a more contextualized approach which takes a critical look at how preexisting social roles and relationships (especially gendered ones) are reproduced in the computer studies learning environment.

These two authors carried out a study of sixty-nine African-American and Hispanic female students in a polytechnic degree programme in information systems and engineering:

Previous experience in mathematics did not significantly predict these women's grades in their precalculus and calculus courses. Moreover, it did not predict grades in computer science courses for women who continued in computer-related fields.³⁴

These authors call for a new research agenda on gender differences in computing performance. This new agenda, they argue, must seek to avoid confounding the sex differences in mathematics performance with those of computer learning and participation. They suggest that a new paradigm of creative computing is emerging: one which would reflect the fact that creative computing now relies at least as much upon language, visual design, problem definition, and organizational skills as upon quantitative analysis.

³³ Ibid, pp 162-163.

³⁴ Ibid, p 169.

The 'soft', or bricolage computing style, (and the field dependence tendency) may not necessarily militate against those who hold them: Turkle and Papert (1990) show that the bricolage style has a record of success in software design and programming. Paul Feyerabend (1975), in an essay entitled Against Method, argues that the history of scientific achievement is not a seamless progression of cumulative work which employed increasingly sophisticated rational procedures. Rather, according to Feyerabend, scientists have had to improvise when they came up against anomalies, and to devise 'work-arounds' when their theories did not conform to reality; rather like Turkle and Papert's bricoleurs. In making a case for an 'anarchistic' theory of knowledge, Feyerabend cautions that we should not privilege reason over other strategies of knowledge acquisition.

2.7 Theoretical Linkages

This study attempts to link field independence as a strategy of perception with the 'hard', abstract approach to using computers. The researcher posited that persons who tended toward the field independence end of the continuum would favour the abstract, formalistic style of using computers. As discussed above, field independence persons are adept at disembedding, and this ability, it is proposed, is parallel to an approach to computing which favours breaking the task at hand into discrete elements. As computer programmers and users, such persons would be expected to favour the use of flowcharts and algorithms, and to stick to established procedures in using the computer.

It is also posited that persons who are field dependent would adopt the concrete or 'bricolage' approach to computing. Field dependent persons are less prone to disembed, as such, it is argued that they would adopt the more holistic approach of the bricoleur. In using the computer, such persons would rely less on flowcharts and algorithms than would field independent persons, and would treat the problem at hand as a whole, arriving at a solution by 'successive approximations', by trying out different approaches to solving the problem, making changes in the computer program more by intuition than according to a predetermined plan.

SECTION 3

METHODOLOGY

The methodology employed in the study sought to apply both quantitative and qualitative research techniques. A structured interview schedule for students and secondary data analysis were used to develop the quantitative dimension, while open-ended interviews with teachers and observation of the classroom and computer laboratory environment added the qualitative dimension.

3.1 The Group Embedded Figures Test

The Group Embedded Figures Test is a perceptual test. The subject's task is to locate a previously seen figure within a larger complex figure which has been organized so as to obscure the sought-after simple figure. The test seeks to assess the subject's ability to disembed³⁵. The test consists of three sections: a first section which is not scored and used to familiarise the subject with the test requirements; second and third sections consisting of nine complex figures each. The subject has two minutes to complete the first section and five minutes each for the second and third sections (see Appendix 5 for sample items from the Embedded Figures Test and the scoring key). The tests developers cite several studies employing correlational and factor analytic techniques which demonstrate the validity and the test/re-test reliability of the Embedded Figures Test³⁶.

3.2 Definitions of key concepts

3.2.1 Cognitive style

According to Witkin et al (1971: 3), cognitive style refers to:

... characteristic, self-consistent modes of functioning which individuals show in their perceptual and intellectual activities. These cognitive styles are manifestations in the cognitive sphere of broader dimensions of personal functioning which cut across diverse psychological areas.

³⁵ Herman A. Witkin, et al, A Manual for the Embedded Figures Tests, California, Consulting Psychologists Press, 1971.

³⁶ Ibid, pp 18 - 20.

Cognition consists of a variety of abilities, amongst which are perception, and the Embedded Figures Test is, according to these authors, designed to study differences in how subjects perceive their surroundings.

3.2.2 Field dependence/independence

Witkin et al (1971: 4), describe field dependence as a continuum which measures the perceptual aspects of cognitive style:

In a field-dependent mode of perceiving, perception is strongly dominated by the overall organization of the surrounding field, and parts of the field are experienced as 'fused'. In field-independent mode of perceiving, parts of the field are experienced as discrete from organized ground. Scores from any test of field dependence form a continuous distribution.

3.2.3 Formal, abstract approaches to computing

The computer user who relies on careful, systematic planning before using an application or creating a computer program, is said to employ a formal, abstract approach to computing. Such persons rely heavily on flowcharts and algorithms in the design of their computer programs: they seek to create a formal model of the desired end-product before actually writing code in a computer language (Papert and Turkle, 1990).

3.2.4 Concrete approaches to computing (bricolage)

The computer user who relies mainly on intuition and who creates computer applications by trial and error, by successive approximations each of which relies on the outcome of the last try, eventually approaching the desired goal, employs a concrete approach to computing. Such persons may redefine their goal and methods as they work and do not rely mainly upon formal models of the desired application as they work. Such persons have been designated bricoleurs, and their computing style bricolage, after anthropologist Claude Levi-Strauss (Papert and Turkle, 1990).

3.2.5 Gender, sex and gendering

Gender refers to the socially constructed differences between masculine and feminine aspects of the human. It differs from sex i.e. male and female, which are biological categories. Gender refers to the network of social norms and expectations which attach to persons by virtue of their being either male or female. Gendering is the social

process wherein males and females come to assume the gender identities of their society.

3.2.6 Epistemological pluralism

According to Turkle and Papert (1990: 129), epistemology is an enquiry into the nature of knowledge. For them epistemological pluralism is a concept which sees 'different approaches to knowledge as styles, each equally valid on its own terms'.

3.2.7 Type of school

This simply considers the gender composition of the school: male, female or coeducational.

3.2.8 Teacher expectations of student aptitude

This assesses the views of the teacher on the aptitude for computer studies of the class as a whole and any individual in the class.

3.2.9 Teacher evaluation of student computing style

Teachers were asked for their views on how their students were positioned along a continuum from a formal, abstract approach to computing, to a concrete approach.

3.3 Variables

The variables used in the study are identified in Table 3.1 below.

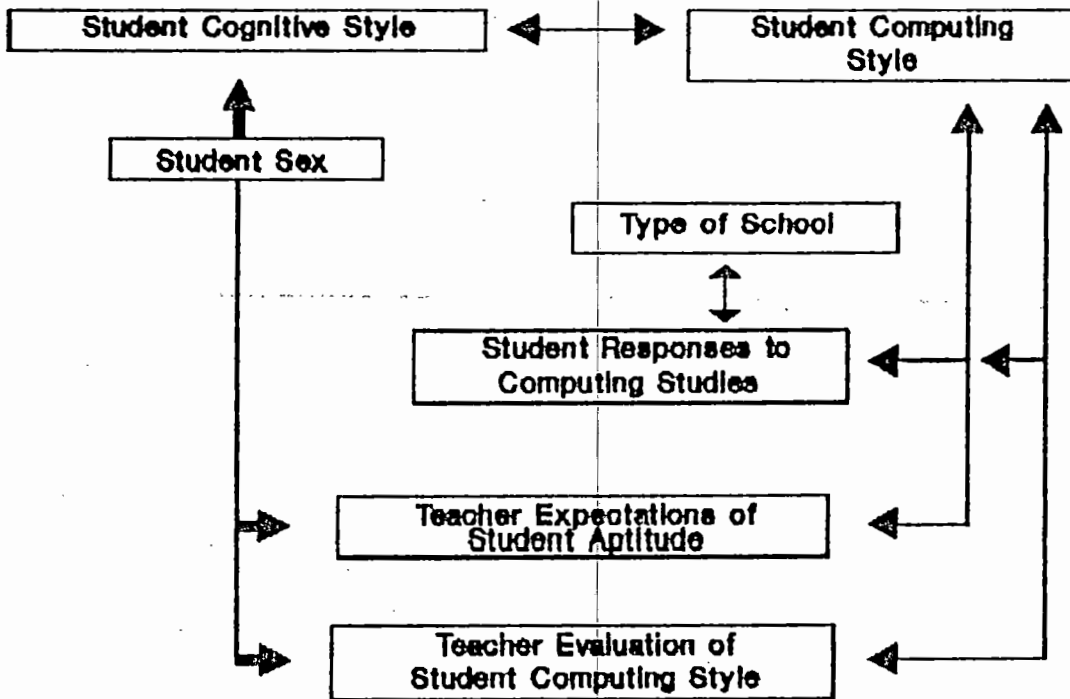
TABLE 3.1
VARIABLES USED IN THE STUDY

Variable Name	How Assessed	Type	Scale
GEFT Score	GEFT test	Stim. Resp.	Nom.
Student computing style	Questionnaire items	Resp.	Nom.
Student responses to computing studies	Questionnaire items	Resp.	Nom.
Student cognitive style	GEFT score	Stim. Resp.	Int.
Student sex	Questionnaire item	Stim.	Nom.
Type of school	Questionnaire item	Stim.	Nom.
Teacher expectations of student aptitude	Open-ended interview	Stim.	Nom.
Teacher eval. of student computing style	Open-ended interview	Stim.	Nom.

3.4 Research Model

A graphical representation of the research model is presented in Figure 3.1. The directed line segments represent relationships, they are not meant to indicate causality.

Fig. 3.1 The Research Model



3.5 Selection and Characteristics of the Sample

Four institutions were selected which offered training for the computer studies course of the General Certificate of Education Ordinary Level (GCE O'level hereafter) or the Caribbean Examinations Council General Proficiency (CXC hereafter). Initial discussions with two educational professionals with whom the researcher is acquainted, and with a librarian at the University's Faculty of Education, confirmed by data from the Ministry of Education, revealed that most secondary schools in Jamaica did not offer computer studies. The schools which do offer computer studies are not evenly distributed throughout the island. As such, the researcher decided that a random sampling approach would be unsuitable in selecting schools in which to carry out the research: the purposive sampling technique was employed. The selected institutions were identified from schools in the Kingston Metropolitan area which offered either CXC or GCE computer studies. These institutions had the following characteristics:

1. Two were co-educational, one single-sex male and the fourth single-sex female. The intention in selecting this range of schools was to get some indication as to whether the gender composition of the school had any significant effect on the responses of the students.

2. The school populations were broadly comparable in terms of the students' socio-economic status (SES). An attempt was made to minimise the range of the socio-economic status of the students from school to school. The researcher asked two educational professionals, neither of whom had worked with any of the selected schools, as well as the computer studies teacher in each school for opinions regarding the overall SES of the schools' students. There was consensus of response for the two single-sex schools: the girls' school was viewed as mainly drawing students from middle and upper-middle class background, and the boys' school from mainly middle class backgrounds. No consensus was had on either of the two co-educational institutions, but it was felt that the students were largely middle-class. For the sample of students as a whole, the researcher could only hold the expectation that the SES difference would be random, and attempt, through obtaining information on parental occupation and education, to access the actual SES of each student.

3. All classes pursuing GCE or CXC Computer Studies in the selected schools were incorporated in the sample. As it turned out, in each school, there was only one class being prepared for the GCE or CXC examinations in June of 1993.

3.5.1 Characteristics of schools

The first co-educational school is a high school off Old Hope Road, a few minutes outside Liguanea. This school will be referred to as school A. In the opinion of two educational professionals whom the researcher consulted, this was not a 'prestigious' high school, and the students were more likely to come from working or lower middle class backgrounds, rather than middle or upper class. Students in the selected class were all in grade 11/fifth form. This school prepared students for the CXC General Proficiency³⁷ syllabus.

The second co-educational institution (school B) is a private school which specialises in computer skills training. It is located off Half Way Tree road, near to Crossroads. Students in the selected class were in regular high school (fourth or fifth form), technical or community college or in employment. These students were being prepared for the GCE O'level syllabus.

The single-sex male school (school C) is quite well-known in Jamaica, with a history going back to the last decade of the previous century. According to the researcher's two educational professionals, it was once one of the most 'prestigious' boys' high schools in Jamaica, but since the 1970s more working-class boys attend so the school has lost some of its prestige. Students were prepared for the GCE O'level syllabus.

The single-sex female school (school D) is one of the 'top three or four' girls' high schools in Jamaica, in the opinion of the researcher's two educational professionals. Students are being prepared for the CXC General Proficiency syllabus.

School A, with 1 teacher and 5 students was used for the pilot study.

For the main sample, the researcher aimed at working with at least twenty (20) students in each school (total of 60), and (1) teacher per school (total of three). The classes turned out to be somewhat smaller than expected, so the final sample consisted of forty-seven (47) students and three teachers, for the three schools used in the actual study.

³⁷ The CXC syllabus is discussed in detail in section 4.11 below.

3.6 Gaining Access

Similar procedures were followed for the pilot and main sample schools. Having selected the four institutions, initial telephone contact was made: upon the first call to each school, the researcher would ask to speak with the computer studies teacher. This was followed up by a visit during which the researcher introduced himself and presented a letter of introduction from his supervisor at the Consortium Graduate School; one copy of which went to the School's principal and the other to the computer studies teacher. In the case of the two single sex schools, between four and six weeks passed between making initial contact and actually commencing the interviews. The two major factors which were responsible for the delay were first, the tight pre-examination schedule in each school, and second, the two-week Easter holiday break. These two factors caused a break of nearly five weeks in the actual data-collection phase of the research project. Despite this setback, it was the case with each of the four schools that, upon contact, the computer studies teachers expressed considerable interest, even enthusiasm, regarding the study.

3.7 Pilot test of student questionnaire

The student questionnaire was pilot tested at school A. Based on this pilot test the researcher found no need to make any changes in the questionnaire schedule. It was decided, however, to administer the questionnaire in groups rather than individually, as it appeared from the pilot phase that problems would be encountered in getting the students to keep individual appointments for the interview.

3.8 Administering the Group Embedded Figures Test and the Student Questionnaire

On the agreed days for the student interviews, the researcher would arrive at the school in question, meet the computer studies teacher, and proceed to a classroom. Through prior arrangement, a group of students would be assembled there. The researcher would introduce himself and explain the nature of the study.

At this point, the researcher would answer any questions from the students. That done, the Embedded Figures Test would be administered as follows: First, a test booklet would be given to each student. Then, the instructions for the Embedded Figures Test would be read out loud by the researcher. Then the students would be asked to begin work on the test. The researcher would keep time and inform the students when it was time to stop working. Finally, the students would be asked to pass the

test booklets to the front of the class and the researcher would thank them for their cooperation.

In the case of the girls' school, school D, the interviews were administered on different days, with small groups, subsequent to the Embedded Figures Test, because the students had other class commitments immediately they finished the test. With regard to the other two schools: at School C, it was possible to move straight into the interviews after the test, and thus deal with all the students in one session; at school B, like school D, subsequent visits were required to complete the interviews.

3.9 Teacher Interviews

These were conducted from the time of initial contact. The researcher developed an elite interview schedule, consisting of items such as teacher's background, knowledge and experience of computing, responses to issues of gender and overall assessments of students. Over the course of several visits to each school, these items were covered with each of the three teachers.

3.10 Observation of computer facilities at each school

This was done according to a schedule and, like the teacher interview, was covered in more than one visit. For each school, the number and type of computers, as well as the type of software, reference material on hardware, software, and computer studies generally, were recorded.

3.11 Secondary data

In order to acquire background and contextual understanding of the research problem, the syllabus of each examination was obtained and comparisons of content and objectives were made.

SECTION 4

PRESENTATION AND DISCUSSION OF FINDINGS

4.1 Overview of sample

The final sample consisted of 47 persons, distributed amongst three schools. There were 22 males and 25 females: 16 in the girls' school, 16 in the boys' school, and 15 (males and females) in the co-educational school;

see Table 4.1. In the co-educational school there were 6 males and 9 females.

TABLE 4.1

**DISTRIBUTION OF SAMPLE
BY SCHOOL TYPE AND SYLLABUS**

Type of School	Syllabus	No. students
Girls	CXC	16
Co-ed	GCE	15
Boys	GCE	16
		47

As can be seen in Table 4.2, 19 of the males and 22 of the females in the sample are in the 14 - 17 age group. The 6 persons in the 18 and over age group are from the co-educational institution, which, unlike the other two schools, offers classes to both adolescents and adults.

TABLE 4.2

AGE DISTRIBUTION OF SAMPLE BY SEX

Age range	Male	Female	Total
14 - 17	19	22	41
18 and over	3	3	6
	22	25	47

4.2 Scores for the Group Embedded Figures Test

To facilitate different types of analysis, the GEFT scores were processed in two forms: in the raw form and grouped into three equal bands (0 - 6, 7 - 12, and 13 - 18). The scores were kept in raw form to allow comparison of means for males and females, while grouping into bands allowed placing of the students into three wide bands: field dependent (GEFT of 0 - 6); indeterminate (GEFT of 7 - 12); and field independent (GEFT of 13 - 19).

With reference to Table 4.3, we see that the mean GEFT score for males and females differs by less than 1. The

mean and median for females are both slightly higher than for boys.

TABLE 4.3

STATISTICS ON RAW GEFT SCORES

	Male	Female
Mean	10.13	10.60
Median	9	11
Mode	8	9
Standard Deviation	4.54	5.19
Maximum	18	18
Minimum	3	1
Range	15	17
	n = 22	n = 25

A comparison of means on the raw GEFT scores for males and females in the sample was carried out with the results presented in Table 4.4, which we interpret as follows: the comparison of mean GEFT scores for males and females yields a t value of $-.33$ with a $.75$ (.746) probability of being due to random error. Of course, being aware that our sample was not randomly drawn, we must interpret these results with extreme caution: it does appear, though, that there is no statistically significant difference between the mean GEFT scores of males and females.

TABLE 4.4

COMPARISON OF MEANS OF RAW
GEFT SCORE BY SEX

t value	D.F.	2-Tail Prob.
$-.33$	45	.746

Females = 25, Males = 22, n = 47.

When the GEFT scores were grouped into three bands and displayed according to sex, the result was Table 4.5. We see that 4 males and 6 females can be classified as field dependent (GEFT score 0 - 6); 12 males and 9 females are indeterminate (GEFT score 7 - 12); and 6 males and 10 females are field independent (GEFT score 13 - 18). From

this we can see that there is no statistically significant sex difference on this measure for our sample.

TABLE 4.5
GROUPED GEFT SCORE BY SEX

GEFT Score	Male	Female	Total
0 - 6	4	6	10
7 - 12	12	9	21
13 - 18	6	10	16
	22	25	47

Chi-square = 1.64378 Sig. = .4396

When we look at the grouped GEFT scores by school (Table 4.6), controlling for sex, we see a significant difference. The females in the co-educational school tend towards the field dependent end of the GEFT scale, only 1 of the 9 was clearly field independent (score 12 - 18), the other 8 were field dependent (4) or indeterminate (4). So we see that there is a difference between the coeducational and girls' schools in how females in the sample are placed along the GEFT continuum.

TABLE 4.6
GEFT SCORE BY SCHOOL CONTROLLING FOR SEX

GEFT Score	Coed.		Girls		Boys		Tot.
	Male	Fem.	Male	Fem.	Male	Fem.	
0 - 6	1	4	-	2	3	-	10
7 - 12	2	4	-	5	10	-	21
13 - 18	3	1	-	9	3	-	16
Total	6	9	-	16	16	-	n=47

Chi-square (males) = 2.25347 Sig. = .3241

Chi-square (females) = 5.66165 Sig. = .0590

4.3 Relationship between parents' educational and occupational levels and students grouped GEFT score

The possibility of any relationship between students' grouped GEFT score and parents' educational level, parents occupational level was examined. The tables are presented in Appendix 2; on the basis of the chi-square test, no significant sex differences were found.

4.4 Sex and career goal

The relationship between sex and career goal was examined in Table 4.7. No significant sex differences were found, based on the result of the chi-square.

TABLE 4.7

CAREER GOAL BY SEX

Career type ³⁸	Male	Female	Total
Managerial/Admin.	2	6	8
Traditional Profess.	3	6	9
Technology Professional	14	11	25
Skilled Craftsperson	1		1
Self-employed		1	1
No answer	2	1	3
	22	25	47

Chi-square = 5.52435

sig. = .3553

This is of interest to the researcher in light of previous work on career choice amongst Caribbean secondary school students which indicated that females were more likely to choose occupations which were traditionally seen as the preserve of women: nursing, homemaking, teaching, and secretarial. In a review of this literature, Olive Senior concluded:

Research in the Caribbean confirms findings from elsewhere about gender-stereotyped behaviour - girls 'are encouraged to be unassertive ... and dependent', in keeping with the perceptions of the idealized feminine image, while boys 'learn

³⁸ See appendix 1 for full explanation of these career categories.

early in life that self-assertion will not meet with negative reprisals' ...

Thus the stage is set for the enactment of behaviours associated with gender-role stereotypes: conforming girls, challenging boys³⁹.

We see in Table 4.7 that 6 females as opposed to 2 males in the sample opted for administrative or managerial occupations; 6 females against 3 males desired to become traditional professionals; 11 females against 14 males wished to become technology-related professionals. With respect to the technology related professions, it is of interest that one male and three females wished to become airline pilots. It should be noted too, that in all four cases, this desire was not unrealistic in the sense that both the male and females intended to study mathematics and/or physical sciences at Advanced level, and to go on to further education in science or engineering.

Bearing in mind the non-random nature of the sample, it would appear that the gender-role stereotyping as discussed by Senior is not at work here, and there is no disadvantage evident among females in the making of career choices.

When career goal was examined by school, controlling for sex, no significant sex differences were found (Table 4.8). The school did not appear to impact on the career choices of males and females, but we note that 5 of the 6 males in the co-educational institution were desirous of pursuing careers in a technology-related profession.

³⁹ Olive Senior, Working Miracles: Women's Lives in the English-speaking Caribbean, Barbados, ISER, 1991 (p 61).

TABLE 4.8

CAREER GOAL BY SCHOOL CONTROLLING FOR SEX

Career Type	Coed		Girls		Boys		Tot
	M	F	M	F	M	F	
Managerial/Admin.		2	-	4	2	-	8
Traditional Prof.		4	-	2	3	-	9
Technology Prof.	5	3	-	8	9	-	25
Skilled Crafts.			-		1	-	1
Self-employed			-	1		-	1
No answer	1		-	1	1	-	3
	6	9		16	16		47

Chi-square(males) = 3.27381 sig. = .5131

Chi-square(females) = 3.95623 sig. = .4120

4.5 Intention to further studies in computing

When students indicated their intention to further their studies in computing, the responses were tabulated according to sex. The results are in Table 4.9. No significant sex differences were found.

TABLE 4.9

INTENTION TO FURTHER STUDIES IN COMPUTING BY SEX

	Male	Female	Total
Yes	18	19	37
No	2		2
Not sure	2	6	8
	22	25	47

Chi-square = 3.85123 sig. = .1458

When the stated intention to further studies in computing was looked at by school, controlling for sex, the results were as presented in Table 4.10. We see that while all of the females in the sample from the girls' school intended to further their studies in computing, 6 of the 9 females in the coeducational school did not. On as small a sample as this, such a finding may or may not be

indicative of some factor or factors which impact negatively on females' decision to pursue studies in computing, in the coeducational as opposed to the single-sex female learning environment. Apart from this, no significant sex differences were found.

TABLE 4.10

**INTENTION TO FURTHER STUDIES IN COMPUTING BY SCHOOL
CONTROLLING FOR SEX**

	Coed		Girls		Boys		Tot.
	M	F	M	F	M	F	
Yes	6	3		16	12		37
No		6			2		8
Not sure					2		2
	6	9		16	16		47

Chi-square(males) = 1.8333 sig. = .3998
 Chi-square(females) = 10.61807 sig. = .0011

The respondents were asked how they intended to further their studies in computing. The results are in Table 4.11.

TABLE 4.11

**HOW THE RESPONDENT INTENDS TO FURTHER STUDIES IN
COMPUTING BY SEX**

	Male	Female	Total
Additional courses	3	7	10
Post sec./Univer.	13	10	13
On the job	1	2	3
Self instruction			
No answer	5	6	11
	22	25	47

Chi-square = 3.23316 sig. = .5254

No significant sex difference was found. We note that 13 males as against 10 females intend to study computing at the post secondary or university level.

When we look at these responses by school, controlling for sex (Table 4.12), we see that, within the female group, the difference is accounted for by six females in the coeducational school who do not intend to further their studies in computing.

TABLE 4.12

HOW THE RESPONDENT INTENDS TO FURTHER STUDIES IN
COMPUTING BY SCHOOL, CONTROLLING FOR SEX

	Coed		Girls		Boys	Tot.
	F	M	F	M		
Additional course			7	3		10
Post sec/Univer.	2	4	8	9		23
On the job	1	1	1			3
Self-instruction				4		4
No answer	6	1				7
	9	6	16	16		47

Chi-square(males) = 4.00513 sig. = .2609

Chi-square(females) = 15.88542 sig. = .0012

4.6 Responses to elements of the course structure

The respondents were asked for their opinions on the structure of their computer studies course: the length of time devoted to hands-on work; length of time devoted to classroom work; and whether they thought the coursework assignment involved too much or too little work. The results are presented in Table 4.13.

With regard to the question about the periods devoted to classroom work, there were significant differences between male and female responses. We see that 1 of male as against 8 females thought that too little time was devoted to classroom work; 6 males as against 12 females thought that too much time was spent on classroom work; 13 males as against 5 females felt that the time devoted to classroom work was adequate. This shows a wider spread of opinions amongst the females in the sample than the males. Regarding coursework, we see that 8 females as against 1 male thought that there was too much coursework.

These differences may be accounted for either by the school or by the syllabus - we note that in the sample, it is the females in the all-girls school who pursue the

CXC syllabus, while the other two schools pursue the GCE syllabus. Apart from these no sex differences were found.

TABLE 4.13

RESPONSES TO COURSE STRUCTURE BY SEX

Response	Hands-on Periods		Classroom Periods		Coursework	
	M	F	M	F	M	F
Too little	12	11	1	8	3	2
Too much	1	1	6	12	1	8
Just right	7	13	13	5	16	15
Don't know	2		2		2	

Chi-square = 3.66693 sig. = .2997 n = 47

TABLE 4.14

RESPONSES TO QUANTITY OF COURSEWORK BY SCHOOL,
CONTROLLING FOR SEXFemales

Girls Coed

Response	Girls	Coed	
Too little	1	1	
Too much	2	6	
Just right	13	2	
Don't know			
	16	9	n=25

Chi-square = 8.79630 sig. = .0123

Responses to the course structure by school, controlling for sex, showed no significant sex differences, with the exception of the students in the girls' school, 13 of whom found the course work adequate, as opposed to 2 of the females in the co-ed school (see Table 4.14). On the other hand, 6 of the females in the coed school found the coursework too much as opposed to 2 in the girls school.

This difference yielded a chi-square of 8.79630 with a significance of .0123.

4.7 Extra reading, computer courses and computer in the home

The students were asked if they read any computer books or magazines apart from their textbooks; if they had taken any computer courses outside of their present course; and if they had a computer in their home. The responses are summarised in Table 4.15. Based on the chi-square test, there were no significant sex differences.

TABLE 4.15

EXTRA READING, EXTRA COURSES, HOME COMPUTER

Response	Read add. books/mags.		Any other course		Computer in home	
	M	F	M	F	M	F
Yes	15	13	6	9	7	6
No	6	12	16	16	15	19
No answer	1					
Chi-square	2.96344		.10686		.07352	
Signific.	.2272		.7437		.7863	

4.8 Reasons for choosing computer studies

The respondents were asked to indicate whether each of a list of reasons was of major, minor or no importance in their decision to take computer studies. The results are presented in Tables 4.16.1 and 4.16.2. We see that for both sexes, intrinsic reasons were of greater importance in the decision to take computer studies than were extrinsic reasons. Apart from this, no sex difference was found, based on the chi-square statistic.

TABLE 4.16.1

INTRINSIC REASONS FOR CHOOSING COMPUTER STUDIES BY SEX

Learn about computers	Male	Female
Major	18	23
Minor	3	1
Not important	1	1
Chi-square = 1.424 sig.=.4906		
Qualify for occupation		
Major	17	15
Minor	4	8
Not important	1	2
Chi-square = 1.606 sig. = .4478		

n = 47

TABLE 4.16.2

EXTRINSIC REASONS FOR CHOOSING COMPUTER STUDIES BY SEX

Parental expectation	Male	Female
Major	7	7
Minor	4	10
Not important	11	8
Chi-square = 2.865 sig.= .2387		
Suggestion of friends		
Major	2	1
Minor	8	13
Not important	12	11
Chi-square = 1.3814 sig. = .5012		
Teachers' advice		
Major	1	1
Minor	6	13
Not important	15	11
Chi-square = 3.0151 sig. = .2214		

n = 47

4.9 Scale of responses to statements about computing

The respondents were presented with a series of statements about computing, in an attempt to develop an instrument which could be used to assess computing style. In their original form, the responses were coded: 1 and 2 for agree strongly and agree; 3 and 4 for disagree and disagree strongly; 8 for no opinion. For analysis, these were collapsed to a 3 point scale with 3 and 1 being used for agree and disagree if the statement reflected a global or abstract orientation, and 1 and 3 being used for agree and disagree if the statement reflected a concrete or restricted orientation dimension. Higher scores on this scale indicate abstract, global orientation, while lower scores would indicate concrete, restricted orientation.

In order to evaluate the usefulness of this scale, a correlation matrix was produced which incorporated the responses to all eleven statements: a new variable was computed by summing the responses on all eleven statements for each case, and this new variable was incorporated into the matrix. The full matrix is presented in Appendix 3. The following discussion will refer to same. The codes (TOT; ST1 to ST11) which correspond to each statement, and the orientation of that statement are presented below:

- TOT:** total score on the eleven items as described below.
- ST1:** Computer studies is a subject which every secondary school student should take. (Global orientation).
- ST2:** Computer studies is a subject best suited for students pursuing mainly Mathematics and Science subjects. (Restricted orientation).
- ST3:** Computer studies is a subject better suited for males rather than females. (Restricted orientation).
- ST4:** Computer studies is a subject best suited for persons who intend to get into science or engineering.
- ST5:** Computer Studies is a subject best suited for persons who intend to get into business. (Restricted orientation).
- ST6:** Creating a computer program requires a detailed plan (flowchart). (Abstract orientation).
- ST7:** If you create a plan or flowchart then you should stick to the plan (flowchart) as closely as possible. (Abstract orientation).
- ST8:** Creating a computer program is a process of trying out different approaches until you find the one that achieves your goal. (Concrete orientation).
- ST9:** If you make a plan or flowchart then you should not depend only upon the plan or flowchart, but should change your approach if necessary. (Concrete orientation).
- ST10:** Before trying a new command or procedure on the computer, you should wait until the teacher discusses it or you read about it in the textbook. (Concrete orientation).
- ST11:** Computers are only machines, they have no

intelligence. (Restricted orientation).

In the following discussion, significant correlations are those with absolute values equal to or greater than .30.

From the correlation matrix, we see that statement 2 displays positive correlation with statement 4 (.44), and with statement 5 (.46). These three statements all have a restricted orientation: they suggest that computer studies should be restricted to persons preparing for specified careers. We see too that statements 4 and 5 correlate highly with each other (.70). So we conclude that these three statements appear to be measuring the same response orientation.

Statements 3 and 6 display weak positive correlation which appears to spurious: it is not clear why computer studies being better suited for males (statement 3 should be related to whether one should create a flowchart when writing a computer program (statement 6).

Statements 6 and 7 display positive correlation (.54). This appears reasonable as both statements have an abstract orientation, they both elicit responses on an abstract, formal approach to computing: the use of flowcharts in programming (statement 6); and on following such flowcharts as closely as possible (statement 7).

The sum of the responses on all statements for each student (STMSUM) was found to significantly correlate positively with statements 1 to 6, but correlations for statements 7 to 11 were insignificant (less than .30).

A summary of responses to all eleven statements are presented in Table 4.17.

We see no significant sex differences except for statement 10 (chi-square 7.19497 and significance .0274) This statement says that before trying an unfamiliar command or procedure on the computer, one should first consult the teacher or read about this command or procedure in the textbook. We see that 7 males agreed as opposed to 17 females. This implies that females in the sample are more cautious in their approach to computing than males, and appear to be more reliant on the authority of the teacher and or the textbook for guidance in the use of the machine. The means for males and females on the score for each statement were compared. Based on the results of a t test, no significant sex difference was found.

TABLE 4.17
RESPONSES TO STATEMENTS ABOUT COMPUTING

Statement	Agree		Disagree		No Opinion	
	M	F	M	F	M	F
1	19	23	1	2	2	
2	7	5	15	20		
3	2		17	25	3	
4	11	6	10	19	1	
5	10	8	9	17	3	
6	18	25	4			
7	19	25	3			
8	16	20	5	5	1	
9	19	22	3	3		
10	7	17	13	8	2	
11	14	17	4	7	4	1

The means on the total score were compared for males and females. The results of a t test of these means is in Table 4.18 below. We conclude that there is a significant differences between the mean for males and that for females.

TABLE 4.18

COMPARISON OF MEANS OF TOTAL SCORE ON RESPONSES TO COMPUTING STATEMENTS BY SEX

t value	D.F.	2-Tail Prob.	Mean	Stand. Dev.	Stand. Error
-2.37	45	.022	M=23.1818 F=25.1608	M=3.142 F=2.577	M=.670 F=.515

Females = 25, Males = 22, n = 47.

4.10 Most and least liked subject areas

Students were asked which subjects in their curriculum they liked least and most. The responses are presented in Appendix 7. On the basis of chi-square, no significant sex difference was found.

4.11 Comparison of the Caribbean Examinations Council syllabus in Information Technology and the Cambridge General Certificate of Education syllabus in Computer Studies

4.11.1 Aims and objectives

The two syllabi are broadly similar in terms of their aims and objectives. Both make reference to a need to prepare students for a world in which information technology is playing an increasingly important role, both aim to equip students with a broad overview of the field of information technology, and both seek to foster problem identification and problem solving skills in the student.

The Cambridge syllabus is integrated, all candidates are prepared for one examination, while the CXC syllabus has two options:

The General Proficiency programme is designed for candidates who are interested primarily in foundation for post-secondary studies in Information Technology while the Technical Proficiency programme is designed for candidates who are primarily interested in the development of entry level skills for employment as well as further training in the field.

The General Proficiency syllabus caters to a more general education approach than the Technical Proficiency which concentrates more on named Productivity Tools: Word Processing, Spreadsheets and Database Management⁴⁰.

So the CXC syllabus attempts to cater to different requirements of the students. A potential problem, which it is too soon to examine because 1993 is the first year of the CXC examinations in Information Technology, relates to differential evaluation of these two options by institutions of further education and employers, as has been the case with the lower value accorded to the Basic proficiency variant of the CXC exams in other subjects, vis a vis General proficiency.

4.11.2 Assumptions about the incoming student: prerequisites and corequisites

The GCE syllabus assumes no specific knowledge on the part of the new student, apart from having completed three

⁴⁰ Caribbean Examinations Council, Syllabus for Examinations in Information Technology, Barbados, CXC, 1991, p. 1.

years of secondary school. The CXC syllabus expects students to have had Mathematics up to form 3/Grade 9 for both its syllabus options, and it sees keyboard skills as desirable, though not necessary, for the Technical Proficiency option. It would be interesting to see if, in the future, this keyboarding skills recommendation, does not serve to deter males from taking this option.

4.11.3 Links to other subjects

Neither syllabus makes explicit links to other subject areas in the school curriculum. Both claim to be independent subjects, though the CXC syllabus does expect to connect to what its candidates may be doing in mathematics.

4.11.4 Links to the social environment of the student

Both syllabi attempt to show the relevance of information technology/computer studies to the world which the student is likely to encounter outside the classroom. The broad range of areas which have been impacted upon by information technology is given detailed coverage in both syllabi. The GCE syllabus keeps its coverage general, it could be situated within any industrialised society, while the CXC syllabus gives special attention to information technology applications in areas of special relevance to Caribbean development, like tourism and agriculture.

4.11.5 Assessment

The GCE syllabus employs two papers in its assessment of candidates: a two and a half hour written examination, consisting of short-answer and structured questions with no choice, given a weighting of 75%; and a Course Work (school based assessment) project, a piece of work of a substantial nature, carried out over an extended period, with a weighting of 25%.

The CXC syllabus employs 4 papers in its assessment, with differences for Technical and General options.

For the General Proficiency option: paper 1, 1 hour of 10 compulsory short answer questions (30% weighting); paper 2, a one and a half hour practical paper consisting of three compulsory questions, testing use of specific application packages (10% weighting); paper 3, one and a half hours a essay paper in two sections (40% weighting); and paper 4, a school based assessment, comprising a project carried out under supervision over an extended period of time (20% weighting).

For the Technical Proficiency option: 1 hour of 10 compulsory short answer questions (30% weighting); paper 2, a one and a half hour practical paper testing word

processing ability (16% weighting); paper 3, three hours, testing ability in spreadsheet and database management (34% weighting); and paper 4, a school based assessment, comprising a project carried out under supervision over an extended period of time (20% weighting).

We are of the view that the CXC syllabus attempts to test a broader range of abilities than its GCE counterpart: the practical tests in application packages have no GCE equivalent.

4.11.6 Gender awareness

Neither syllabus displays any awareness of a gender dimension to computing. No explicit mention is made of differential impacts of information technology on men and women. This is surprising, in light of the otherwise comprehensive treatment of the social context of this technology and its varied social impacts, in both syllabi.

4.11.7 Computing style promoted

Both syllabi promote a formal, abstract approach to working with computers. Heavy emphasis is placed upon developing formal models of programs and on techniques of structured programming. Compartmentalization of a task to facilitate computer implementation is stressed. The top-down approach to programming is emphasised.

The GCE syllabus places greater stress on formal and abstract approaches than the General proficiency option of the CXC syllabus, which in turn has a more formal and abstract approach than the CXC Technical proficiency option. An awareness of plurality of styles and voices in the computer culture, as discussed by Papert and Turkle (1990), is certainly not in evidence in either syllabus.

4.12 Teachers' views on sex differences in computer studies

4.12.1 On sex differences

The (male) teacher of the coeducational group was of the opinion that females were less interested in the practical aspects of computer studies, and were not as keen to write and test computer programs as were the males. On the other hand, this teacher felt that females were better at applying knowledge from the textbooks in essay or examinations situations. In the experience of the teacher for the male group (a male), his experience was in accordance with that of the teacher of the coeducational group. The teacher of the female group (a female) had no experience in teaching computer science to males and thus could not offer comment on this issue.

4.12.2 On different computing styles

All three teachers felt that there were different styles of working with computers, and they appeared in agreement with the continuum of abstract to concrete approaches as conceptualised by this researcher. However, the three teachers were all agreed that the formal style was the one to be promoted in the classroom environment. In the case of the two male teachers, they felt that the GCE syllabus required them to inculcate formal, abstract methods of programming and using computers in their students. The female teacher felt that there was room for both approaches, and that the CXC's Technical syllabus allowed more space for a concrete approach. She too, believed that the formal approach was the one which should be widely promoted in computer studies classrooms.

Of interest too, is the view expressed by all three teachers, that abstract and concrete styles were not necessarily linked to either sex, indeed, the coeducational teacher was of the view that males tended to display both types of computing style to greater degrees than did females.

4.13 Summary of students' open-ended comments on computer studies

At the end of the student questionnaire, space was allowed in which the students were asked to write any comments they had regarding computer studies, generally. These are summarised below.

The most frequent comment was that computer studies should be more widely available to secondary school students. In addition, 5 male and 9 female students felt that computer studies should start in lower grades or even in primary school. The researcher finds this a reasonable view: the numbers of computer studies students in both the girls' and boys' schools (16 in either case) represent less than 20% of the grade 11 population in either school.

The students from the boy's school were unanimous in expressing a desire for more computers in their school. Their teacher, too, mentioned this in the interview with the researcher: he was of the view that shortage of machines was his major problem.

Interestingly, more females than males felt that the course of study was too theory-oriented and that too much reliance was placed upon textbooks.

4.14 The facilities: hardware and software in the three schools

4.14.1 Hardware and software

All schools relied on IBM compatible machines and ran the same suite of software: Lotus 123 (a spreadsheet); DBASE III/IV (database management); Wordstar or Wordperfect (word processing) and BASIC or pascal (programming languages). The similarity of hardware and software environments seems to be dictated by the similar requirements of both syllabi for application software. In the opinion of all teachers this standardization of software was desirable, because it assured that persons taking either course would have a similar knowledge base. Of the three institutions, the girls' school was the best equipped in terms of hardware: the machines were all of recent (a year or so) specification and featured the latest versions of the aforementioned software packages. It is interesting that none of the students from the girls' school mentioned a shortage of computers as a problem at their school, when it is the case that in their school, only a small fraction of the grade 11 students do in fact take computer studies. The coeducational school, which specialised in computer training, was also well-equipped, but as the teacher there admitted, half of the machines were now obsolete, i.e. they could not use the latest software versions, and he had plans afoot to upgrade these older machines.

4.14.2 Accessibility

In both the boy's and girls' schools, there was one central laboratory, access to which was restricted to persons taking computer science. Additionally, in both cases, the computer resources was seen by the teachers as being in place for the teaching of computer subjects. When asked if there were any plans to use the computer resources as teaching support tools in other subjects, the teachers in both schools replied that there were no firm plans.

The above comments are inapplicable to the coeducational institution as it specialises in computer studies and therefore does not offer the full secondary curriculum as do the other two schools.

4.15 Selection of students to pursue computer studies courses

In the girls' and boys' schools, students are allowed to pursue computer studies based on an assessment of their third and fourth year grades. Both teachers in these

schools indicated that 'better' students (academically speaking) were selected. Students who desired to do computer studies, but who were weak in mathematics were not usually selected. The reason for this, according to these two teachers, was that computer studies was logic-based, and as such, students wishing to take this option should have a sound mathematical background. All of the students from both these schools in the sample, were taking at least 4 other subjects at CXC or GCE in June 1993. All were taking mathematics, and more than half of both males and females were taking at least one science subject.

In the co-educational school, the teacher agreed with the above selection criteria, but at this specialist institution, the ability to pay the required course fees was of equal importance. Only three students of the 15 students from this school, in our sample, were taking four or more CXC or GCE subjects in June 1993.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The conclusions are discussed around the research questions. Due to the non-random nature of the sample, no attempt is made to make predictions or to generalise from the findings of this study. The study is preliminary and exploratory in nature. Any discussion of significance is confined to description of the sample, and can do no more than indicate trends for further study.

5.1.1 Do males and females have different cognitive styles as measured by the Group Embedded Figures Test (GEFT)⁴¹?

This test was administered to all students in the sample. The result, in the form of a numeric score ranging from 0 to 18 was recorded and cross tabulated by student gender as well as school. Means for males and females were compared. The score was also grouped into three bands and crosstabulated by sex. As discussed in section 4.2 above, no significant sex differences were found for the overall sample. When the sample was grouped according to school, however, it was found that 6 of the 9 females in the

⁴¹ This is a standard psychological test of cognitive style, discussed earlier.

coeducational school were at the field-dependent end of the GEFT continuum.

When grouped GEFT scores for females in the coeducational school were crosstabulated by the intention to further studies in computing, we found that the 6 females who were at the field dependent end of the GEFT continuum were the same 6 persons who did not intend to further their studies in computing.

Overall, we conclude that in our sample there are no significant sex differences on cognitive style as measured by the Group Embedded Figures Test.

5.1.2 Does the set of items used to assess the computing style of the student constitute a valid measurement scale of computing style?

In a preliminary attempt to establish the internal consistency of the items, a correlation matrix of responses on these items was constructed and the relationships examined. Meaningful and statistically significant, positive correlations were found for statements 2, 4, 5, 6, and 7, as discussed in section 4.9 above. Meaningful and significant positive correlations were found between the sum of responses on these scale items for each student and statements 1 to 6, but not 7 to 11 (see appendix 3). It would appear that some refinement of the scale is called for.

We conclude, in a preliminary fashion, that, while statements 2 to 7 do correlate with one another, the scale of 11 statements about computing is not internally consistent. This set of items is meant to be a composite of student response to computing, and an indicator of computing style, and value orientation toward computing, but the validity of these items when taken as a composite cannot be determined with the available data.

We conclude therefore, on statistical grounds, that the set of items is not a valid measurement scale of computing style. Nonetheless, there is good theoretical reason to seek to refine these items, expand the scale, and employ them in future research.

5.1.3. Do males and females respond differently to courses in computer studies?

Data here were obtained from: a) questions in the student questionnaire; and b) questions in the teacher interviews. Responses were cross tabulated by student sex and school. When the differences between male and female means for the sum of scores in response to 11 statements

about computing were compared (section 4.9 above), we found no significant sex difference. Some between-school difference was found in that 6 of 9 females in the coeducational school expressed no desire to further their studies in computing (the same 6 who were at the field dependent end of the GEFT continuum). Whether this due to the school or the difference in syllabus between the coeducational and girls' schools remains open at this point.

Also, 6 (crosstabulations revealed them to be the same 6 females who were at the field dependent end of the GEFT scale and who did not wish to further their studies in computing) of the 9 females in the coeducational school felt that their coursework involved too much work, as against 2 females in the girls' school (section 4.6). Again, either the syllabus or school could be a factor here.

Overall, we conclude that there is no difference in male and female response to computer studies, in our sample.

5.1.4 Is cognitive style significantly related to responses to computer studies?

The grouped GEFT scores were crosstabulated with student responses (see section 4.10). No statistical evidence was found of a relationship between cognitive style as measured by the GEFT and responses to computer studies. However, we note that it is in the coeducational school, where 6 of the 9 females are at field-dependent end of the GEFT scale, and these same 6 females do not wish to continue in computer studies. We note too as discussed in 5.1.4, these are the same 6 females who found their coursework too much.

Does computer studies discriminate against field-dependent persons? This finding indicates a possible trend which could be pursued in further research.

5.1.5. Do males and females have different approaches to working with computers?

Data here were obtained from: a) questions in the student questionnaire; and b) questions in the teacher interviews. Responses were cross tabulated by student sex and school. As discussed in sections 4.5 and 4.6, no evidence of a sex difference in approach to working with computers was found. In the opinion of teachers, there was a slight sex difference, but this difference was outweighed by differences within a sex (particularly for males).

5.1.6 Does the sex composition of the classroom: single sex male, single sex female or coeducational, relate to opinions expressed about computer studies courses?

Student responses were crosstabulated by sex and school. Differences were found for females in the coeducational school with regard to intention to pursue computer studies and to quantity of coursework. On other responses, no school differences were found.

5.1.7 Do teachers of computer studies have different expectations about the capabilities of males and females to acquire computer skills?

Data here were obtained from responses to the teacher interview. While teachers did feel that males and females differed at times in their approach to working with computers, no teacher expressed different expectations about the ability of males and females to acquire computer skills. While these are views of three teachers only, this finding suggests a possible trend of equity on the part of teachers of computer studies in their expectations of male and female students.

5.1.8 Summary of conclusions

The students involved in this study appear to be from a select group: both in terms of the position of their schools in the broader school system, as well as the means whereby they were selected to pursue computer studies. This has to be borne in mind when we consider the overall findings of no sex differences in response to computer studies courses.

It would appear that the group consists of mostly highly capable and motivated students, with at least as much differentiation in approach to working with computers within genders as between genders, and this is of greater importance, we suggest, in accounting for the findings than any gender-related factors.

5.2 Recommendations

5.2.1 For further study

It is felt that the following could help to better illuminate the issues raised by this research project. The research instrument should be refined in an overall sense, and specifically with regard to the scale of computing style, in an attempt to establish its validity. Then the study could be carried out on a wider sample of schools, in Jamaica and across the region. This would allow further

types of analysis on the questionnaire responses (e.g. multiple regression). The qualitative dimensions could be strengthened by an ethnographic study of students as they work with computers in their homes and classrooms. A content analysis of textbooks could examine issues of the gendered construction of computer users in instructional materials. Finally, the research instrument could be enhanced by the addition of items which seek to explore the students' understanding of the gender problematic.

The conceptual model as developed by Collis (1990) and discussed above in section 2 could prove useful in future work. This model⁴² contained the following elements:

1. School-related policies and practices;
2. Social expectations; and
3. Personal factors.

With respect to school-related policies and practices, she suggested taking a critical look at policies relating to academic pre- and corequisites, e.g. requiring mathematics as a prerequisite for computer studies. We found that two of our schools did follow such a policy. Collis warns that such policy excludes many persons who could benefit from computer studies. Collis also mentioned restrictive policies regarding access to computer resources in the school; we found this to be case in two of our three schools.

With regard to social expectations about computing as a masculine activity, our study did not look at this in any detail, but it appears a useful area for future work. Similarly, Collis dealt with personal factors regarding lower female self-esteem, and our study did not directly address these.

We suggest that future work in this area could utilise Collis' framework, because at least some of the issues she raises have come out in our findings.

5.2.2 Policy implications

1. Utilising the conceptual framework developed by Collis (1990) and by Turkle and Papert (1990), an evaluation of existing computing studies programmes could be carried out at the national and regional level. Such an evaluation should be sensitive to the possibility of different styles in using computers, and to the broader issue of

⁴² Betty Collis, "Adolescent Females and Computers" in M Ainley, Despite the Odds, op cit, pp 276 - 282.

epistemological pluralism and to practices which exclude persons from computing, e.g. mathematical prerequisites, gender expectations, and restrictive access policies.

2. The utility of using computers in the broader teaching function needs to be looked at. It appears from this study that the computer is seen as mainly a resource for the teaching of computer studies to a select group of grade 10 and 11 students. Access should be made available to other students and subjects apart from computer studies.
3. This suggested evaluation needs to consider the absence of gender categories in the existing GCE and CXC computer studies syllabi. The literature discussed in this study unequivocally argues that gender neutrality often masks androcentric exclusion. Perhaps the CXC syllabus (which is under regional control) could be revised to make it gender aware.
4. The emphasis on formal, abstract approaches emphasised in these syllabi must be critically examined. The literature as discussed in this study suggests that other styles and approaches should be accommodated in the syllabi and teaching methods. This study found preliminary evidence that some persons with a field dependent perceptual style appear to have been put off computer studies. Strategies should be developed for maximising learning among persons showing different perceptual styles.
5. An awareness, on the part of persons making policy for information technology education, of the issues raised in this study could lead to policies which are alert to factors of gender bias in computer studies training.
6. Despite the expressions of the need to broaden training in information technology (Demas, 1990; McIntyre, 1989), this study has shown that within the sampled schools, computer studies is available to a small and select group of better students, or to those who can afford specialised training. Considering the fairly select nature of the schools in the sample, we are not led to believe that nearly as many students are being exposed to computer studies training as the policy imperative would suggest.

We cannot, however, from this study, arrive at a definitive picture of the extent and nature of computer studies training in Jamaica. Further work is called for.

When we consider the social and cultural diversity of the English-speaking Caribbean, the epistemological pluralism as outlined by the feminist theorists discussed above, could serve to inform evaluation of computer studies curricula and programmes. A plural epistemological framework, and an awareness of different learning styles, would appear the most suitable set of conceptual tools with which to work in a multi-cultural, multi-ethnic environment. It is likely that any computer culture which develops in our region would display different styles and voices. We must ensure that we do not exclude any of these.

This study has tried to demonstrate that development of information technology is vital to regional development, even if such development bears risks. To ensure that we benefit to the greatest extent from whatever scarce resources we invest in training in this area we must ensure that both males and females have equality of access and treatment in computer studies training in our schools.

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APPENDIX 1

Explanations of career categories

Managerial/Administrative: salaried persons holding positions of responsibility for staff and/or resources, and who have partial or full input into the decision making process, in either the public or private sector.

Traditional professionals: attorneys-at-law, physicians, surgeons, clergy, chartered accountants, university lecturers.

Technology professionals: engineers, computer hardware and software specialists, systems analysts, airline pilots.

Mid-level professionals: nurses, pre-primary, primary and secondary school teachers, medical/dental assistants, legal aides.

Skilled craftspersons: construction workers, police, fire, homemakers.

Self-employed: identified as such, and not in any of the above categories.

APPENDIX 2

Parents educational and occupational level
by grouped GEFT

TABLE A2.1

GROUPED GEFT SCORES BY FATHER'S LEVEL OF EDUCATION,
CONTROLLING FOR SEX (MALES)

GEFT score range

Level of education	0 - 6	7 - 12	13 - 18	Tot.
Primary, secondary	1	2	1	4
Post sec/university	1	7	2	10
No answer	2	3	3	8
	4	12	6	22

TABLE A2.2

GEFT SCORE BY FATHER'S LEVEL OF EDUCATION, CONTROLLING
FOR SEX (FEMALES)

GEFT score range

Level of education	0 - 6	7 - 12	13 - 18	Tot.
Primary, secondary	2	5	3	10
Post sec/university	3	1	4	8
No answer	1	3	3	7
	6	9	10	25

APPENDIX 2 (contd.)

TABLE A2.3

GROUPED GEFT SCORES BY MOTHER'S LEVEL OF EDUCATION,
CONTROLLING FOR SEX (MALES)

GEFT score range

Level of education	0 - 6	7 - 12	13 - 18	Tot.
Primary, secondary	1	4		5
Post sec/university	3	6	2	11
No answer		2	4	6
	4	12	6	22

TABLE A2.4

GROUPED GEFT SCORES BY MOTHER'S LEVEL OF EDUCATION,
CONTROLLING FOR SEX (FEMALES)

GEFT score range

Level of education	0 - 6	7 - 12	13 - 18	Tot.
Primary, secondary	2	6	2	10
Post sec/university	4	3	8	15
No answer				
	6	9	10	25

APPENDIX 2 (contd.)

TABLE A2.5

GROUPED GEFT SCORE BY FATHER'S OCCUPATION,
CONTROLLING FOR SEX (MALES)

GEFT score range

Occupation	0 - 6	7 - 12	13 - 18	Tot.
Admin./Profess.	1	3	3	7
Skilled/Clerical	1	7	1	9
No answer	2	2	2	6
	4	12	6	22

TABLE A2.6

GROUPED GEFT SCORE BY FATHER'S OCCUPATION, CONTROLLING
FOR SEX (FEMALES)

GEFT score range

Occupation	0 - 6	7 - 12	13 - 18	Tot.
Admin./Profess.	2	3	5	10
Skilled/Clerical	4	5	3	12
No answer		1	2	3
	6	9	10	25

APPENDIX 2 (contd.)

TABLE A2.7

GROUPED GEFT SCORE BY MOTHER'S OCCUPATION, CONTROLLING
FOR SEX (MALES)

GEFT score range

Occupation	0 - 6	7 - 12	13 - 18	Tot.
Admin./Profess.	1	3	3	7
Skilled/Clerical	2	8	3	13
No answer	1	1		2
	4	12	6	22

TABLE A2.8

GROUPED GEFT SCORE BY MOTHER'S OCCUPATION, CONTROLLING
FOR SEX (FEMALES)

GEFT score range

Occupation	0 - 6	7 - 12	13 - 18	Tot.
Admin./Profess.	3	4	6	13
Skilled/Clerical	3	4	3	10
No answer		1	1	2
	6	9	10	25

APPENDIX 3

Correlation matrix for responses to statements about computing

Correlations:	STMSUM	STM1	STM2	STM3	STM4	STM5
STMSUM	1.0000 (.47) P= .000	.0500 (.47) P= .738	.5075 (.47) P= .000	.3767 (.47) P= .009	.6533 (.47) P= .000	.6055 (.47) P= .000
STM1	.0500 (.47) P= .738	1.0000 (.47) P= .000	-.1529 (.47) P= .305	-.0901 (.47) P= .547	.1524 (.47) P= .307	.1155 (.47) P= .440
STM2	.5075 (.47) P= .000	-.1529 (.47) P= .305	1.0000 (.47) P= .000	-.0438 (.47) P= .770	.4421 (.47) P= .002	.4552 (.47) P= .001
STM3	.3767 (.47) P= .009	-.0901 (.47) P= .547	-.0438 (.47) P= .770	1.0000 (.47) P= .000	.1540 (.47) P= .301	.2451 (.47) P= .097
STM4	.6533 (.47) P= .000	.1524 (.47) P= .307	.4421 (.47) P= .002	.1540 (.47) P= .301	1.0000 (.47) P= .000	.7006 (.47) P= .000
STM5	.6055 (.47) P= .000	.1155 (.47) P= .440	.4552 (.47) P= .001	.2451 (.47) P= .097	.7006 (.47) P= .000	1.0000 (.47) P= .000
STM6	.3845 (.47) P= .008	-.0796 (.47) P= .595	-.1786 (.47) P= .230	.3894 (.47) P= .007	.2303 (.47) P= .119	.0326 (.47) P= .828
STM7	.2263 (.47) P= .126	-.0682 (.47) P= .649	-.1529 (.47) P= .305	.1922 (.47) P= .196	-.0267 (.47) P= .859	-.0596 (.47) P= .691
STM8	.2748 (.47) P= .062	.1357 (.47) P= .363	.0660 (.47) P= .660	.0108 (.47) P= .943	-.2321 (.47) P= .116	-.2648 (.47) P= .072
STM9	.1850 (.47) P= .213	-.1609 (.47) P= .280	-.0684 (.47) P= .648	-.0748 (.47) P= .617	-.0921 (.47) P= .538	.1692 (.47) P= .256
STM10	.2902 (.47) P= .048	-.1155 (.47) P= .440	.0355 (.47) P= .813	-.1063 (.47) P= .477	-.0843 (.47) P= .573	.0330 (.47) P= .826
STM11	.0751 (.47) P= .616	-.2668 (.47) P= .070	-.0221 (.47) P= .883	.0277 (.47) P= .853	-.0814 (.47) P= .587	-.2108 (.47) P= .155

APPENDIX 3 (contd.)

Correlations:	STM6	STM7	STM8	STM9	STM10	STM11
STMSUM	.3845 (47) P= .008	.2263 (47) P= .126	.2748 (47) P= .062	.1850 (47) P= .213	.2902 (47) P= .048	.0751 (47) P=.616
STM1	-.0796 (47) P= .595	-.0682 (47) P= .649	.1357 (47) P= .363	-.1609 (47) P= .280	-.1155 (47) P= .440	-.2668 (47) P=.070
STM2	-.1786 (47) P= .230	-.1529 (47) P= .305	.0660 (47) P= .660	-.0684 (47) P= .648	.0355 (47) P= .813	-.0221 (47) P=.883
STM3	.3894 (47) P= .007	.1922 (47) P= .196	.0108 (47) P= .943	-.0748 (47) P= .617	-.1063 (47) P= .477	.0277 (47) P=.853
STM4	.2303 (47) P= .119	-.0267 (47) P= .859	-.2321 (47) P= .116	-.0921 (47) P= .538	-.0843 (47) P= .573	-.0814 (47) P=.587
STM5	.0326 (47) P= .828	-.0596 (47) P= .691	-.2648 (47) P= .072	-.1692 (47) P= .256	.0330 (47) P= .826	-.2108 (47) P=.155
STM6	1.0000 (47) P= .000	.5442 (47) P= .000	.1586 (47) P= .287	.1167 (47) P= .435	-.1860 (47) P= .211	-.0115 (47) P=.939
STM7	.5442 (47) P= .000	1.0000 (47) P= .000	.1357 (47) P= .363	.0999 (47) P= .504	-.1155 (47) P= .440	-.0612 (47) P=.683
STM8	.1586 (47) P= .287	.1357 (47) P= .363	1.0000 (47) P= .000	.2685 (47) P= .068	.1602 (47) P= .282	-.1646 (47) P=.269
STM9	.1167 (47) P= .435	.0999 (47) P= .504	.2685 (47) P= .068	1.0000 (47) P= .000	.0409 (47) P= .785	-.0609 (47) P=.684
STM10	-.1860 (47) P= .211	-.1155 (47) P= .440	.1602 (47) P= .282	.0409 (47) P= .785	1.0000 (47) P= .000	.0086 (47) P=.954
STM11	-.0115 (47) P= .939	-.0612 (47) P= .683	-.1646 (47) P= .269	-.0609 (47) P= .684	.0086 (47) P= .954	1.0000 (47) P=.000

(Coefficient / (Cases) / 2-tailed Significance)

" . " is printed if a coefficient cannot be computed

APPENDIX 4 - STUDENT'S QUESTIONNAIRE

Gender Responses to GCE O'level Computer Studies.

Student Questionnaire

School Background

1. What is the name of your school?

2. Form or Grade: _____

3. What subjects will you be sitting in the CXC/GCE examinations in June?

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

4. Of the subjects you are taking now:

4.1 Which one(s) would you say you enjoy the most? (Rank from most enjoyable, then next most enjoyable, etc)

1. _____

2. _____

3. _____

4.2 Which one(s) would you say you enjoy least? (Rank from least enjoyable, then next least enjoyable, etc)

1. _____
2. _____
3. _____

5. Would you describe yourself as:

	YES	NO	DON'T KNOW
An Arts student?	(1)	(2)	(8)
A Science student?	(1)	(2)	(8)
Both an Arts and Science Student?	(1)	(2)	(8)

6. Do you read any computer books or magazines?

- (1) YES
- (2) NO
- (8) DON'T KNOW

6.1 If yes, what are they, and how often do you read them?

	Magazine/Book	Once Week	Once Month	Occasional.
1.	_____			
2.	_____			
3.	_____			
4.	_____			

7. Have you taken any computer courses outside of your present school?

- (1) YES
- (2) NO
- (8) DON'T KNOW

7.1 if yes, give details:

Name of Course	Where offered

Responses to computing

8. For the following statements, indicate whether you agree or disagree.

		AGREE STRONGLY	AGREE	DISAGREE	DISAGREE STRONGLY	NO OPINION
8.1	Computer studies is a subject which every Secondary school student should study	1	2	3	4	8
8.2	Computer Studies is a subject best suited for students pursuing mainly Mathematics and Science subjects	1	2	3	4	8
8.3	Computer Studies is a subject better suited for males rather than females	1	2	3	4	8
8.4	Computer Studies is a subject best suited for persons who intend to get into Science or Engineering	1	2	3	4	8
8.5	Computer Studies is a subject best suited for persons who intend to get into Business	1	2	3	4	8
8.6	Creating a computer program requires a detailed plan (flowchart)	1	2	3	4	8

		AGREE STRONGLY	AGREE	DISAGREE	DISAGREE STRONGLY	NO OPINION
8.7	If you create a plan or flowchart then you should stick to the plan (flowchart) as closely as possible	1	2	3	4	8
8.8	Creating a computer program is a process of trying out different approaches until you find the one that achieves your goal	1	2	3	4	8
8.9	If you make a plan or flowchart then you should not depend only upon the plan or flowchart, but should change your approach if necessary	1	2	3	4	8
8.10	Before trying a new command or procedure on the computer, you should wait until the teacher discusses it or you read about it in the textbook	1	2	3	4	8
8.11	Computers are only machines, they have no intelligence	1	2	3	4	8

9 Do you talk to the computer as you work with it?

- (1) All the time
- (2) Most times
- (3) Sometimes
- (4) Hardly ever
- (5) Never
- (8) Don't know

10. The periods devoted to actual hands-on computer work are:

TOO LONG	TOO SHORT	JUST RIGHT	DO NOT KNOW
(1)	(2)	(3)	(8)

11. Time spent in the classroom (as opposed to time spent on computers) is:

TOO LITTLE	TOO MUCH	JUST RIGHT	DO NOT KNOW
(1)	(2)	(3)	(8)

12. The number of computers available allows students to work:

SINGLY	IN PAIRS	IN GROUPS OF 3 OR MORE	DON'T KNOW
(1)	(2)	(3)	(8)

13. The coursework in Computer Studies is:

TOO LITTLE	TOO MUCH	ADEQUATE	DO NOT KNOW
(1)	(2)	(3)	(8)

14. Indicate whether each of the following reasons was of major, minor, or no importance in your decision to take Computer Studies.

	MAJOR	MINOR	NOT IMPORTANT
14.1 Parental expectation	1	2	3
14.2 Suggestion of friends	1	2	3
14.3 To learn about Computers	1	2	3
14.4 To qualify for desired occupation	1	2	3
14.5 Teacher's advice	1	2	3
14.6 Other (specify) _____			

Personal and Home background information

15. Age _____ Years

16. Sex (1) MALE (2) FEMALE

17. Which of the following best describes the family structure in which you were brought up?

- (1) SINGLE PARENT (MALE)
 - (2) SINGLE PARENT (FEMALE)
 - (3) BOTH PARENTS
 - (4) GUARDIAN (MALE)
 - (5) GUARDIAN (FEMALE)
 - (6) MALE AND FEMALE GUARDIANS
 - (7) OTHER, PLEASE SPECIFY
- (Skip to Question 20)

(8) NO ANSWER

18. What is the highest level of education attained by your father?

- (1) NO FORMAL EDUCATION
- (2) PRIMARY EDUCATION
- (3) SECONDARY EDUCATION
- (4) TECHNICAL/POST-SECONDARY
- (5) UNIVERSITY
- (8) DON'T KNOW/NO ANSWER

19. What is the highest level of education attained by your mother?

- (1) NO FORMAL EDUCATION
- (2) PRIMARY EDUCATION
- (3) SECONDARY EDUCATION
- (4) TECHNICAL/POST-SECONDARY
- (5) UNIVERSITY
- (8) DON'T KNOW/NO ANSWER

20. What is the highest level of education attained by your male guardian?

- (1) NO FORMAL EDUCATION
- (2) PRIMARY EDUCATION
- (3) SECONDARY EDUCATION
- (4) TECHNICAL/POST-SECONDARY
- (5) UNIVERSITY
- (8) DON'T KNOW/NO ANSWER

21. What is the highest level of education attained by your female guardian?

- (1) NO FORMAL EDUCATION
- (2) PRIMARY EDUCATION
- (3) SECONDARY EDUCATION
- (4) TECHNICAL/POST-SECONDARY
- (5) UNIVERSITY
- (8) DON'T KNOW/NO ANSWER

22. Main occupation of your father: _____
23. Main occupation of your mother: _____
24. Main occupation of your male guardian: _____
25. Main occupation of your female guardian: _____
26. Is there a computer in your home?
- (1) YES
 - (2) NO
 - (8) DON'T KNOW

If yes:

26.1 Who uses it the most?

26.2 What is it normally used for?

- (1) Word Processing
 - (2) Spreadsheet/Accounting
 - (3) Graphics
 - (4) Computer Games
 - (5) Programming (what language?)
-

- (6) Other, (indicate)
- (8) Don't Know

26.3 How often do you have access to it?

- (1) Every Day
- (2) Once or twice a week?
- (3) Only occasionally
- (4) Hardly ever
- (5) Never
- (8) No answer

26.4 What do you do with it?

- (1) Word Processing
- (2) Spreadsheet/Accounting
- (3) Graphics
- (4) Computer Games
- (5) Programming (what language?)
- (6) Other, (indicate)
- (8) Don't Know

Education and Career Goals

21. Do you plan to do A'levels?

(1) YES

(2) NO

(8) DON'T KNOW

21.1 If yes, which subjects?

1. _____
2. _____
3. _____
4. _____

22. Do you plan to further your studies in Computing?

(1) YES

(2) NO

(8) DON'T KNOW

22.1 If yes, how?

23. What job would you like to have when you complete your studies?

4. Is your course in Computer studies preparing you adequately for this job ?

(1) YES

(2) NO

(8) DON'T KNOW

5. Do you have any additional comments that you would like to make relating to computer studies in school generally?

THAT COMPLETES OUR INTERVIEW. THANK YOU.

26. Respondent's reaction to the interview was:

- (1) Very interested, responsive
- (2) Co-operative, fairly responsive
- (3) Reserved, shy, limited response
- (4) Not co-operative, negative

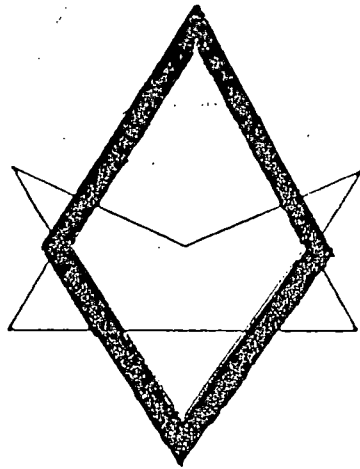
27. Time interview completed: _____

28. Elapsed time (length of interview) _____ minutes.

Interviewer's Signature

APPENDIX 5 - SAMPLE GROUP EMBEDDED FIGURES TEST (GEFT)

Solution:



In the following pages, problems like the ones above will appear. On each page you will see a complex figure, and under it will be a letter corresponding to the simple form which is hidden in it. For each problem, look at the BACK COVER of this booklet to see which simple form to find. Then try to trace it in pencil over the lines of the complex figure. Note these points:

1. Look back at the simple forms as often as necessary.
2. ERASE ALL MISTAKES.
3. Do the problems in order. Don't skip a problem unless you are absolutely "stuck" on it.
4. Trace ONLY ONE SIMPLE FORM IN EACH PROBLEM. You may see more than one, but just trace *one* of them.
5. The simple form is always present in the complex figure in the SAME SIZE, the SAME PROPORTIONS, and FACING IN THE SAME DIRECTION as it appears on the back cover of this booklet.

APPENDIX 6

Grouped GEFT scores by response to statements
about computing

Crosstabulation: ESCORE GEFT Score
 By STM1 Every student should do C.S.

STM1→	Count Row Pct Col Pct	Agree st rongly 1	Disagree 3	Row Total
ESCORE				
0 to 6	1	1 10.0 33.3	9 90.0 20.5	10 21.3
7 to 12	2	2 9.5 66.7	19 90.5 43.2	21 44.7
13 to 18	3		16 100.0 36.4	16 34.0
	Column Total	3 6.4	44 93.6	47 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
1.65653	2	.4368	.638	3 OF 6 (50.0%)

Statistic	Value	Significance
Cramer's V	.18774	
Number of Missing Observations =	0	

APPENDIX 6 (contd.)

Crosstabulation: ESCORE GEFT Score
 By STM2 C.S. best for Math/Science

STM2→	Count Row Pct Col Pct	Agree st rongly 1	Disagree 3	Row Total
ESCORE				
0 to 6	1	3 30.0 25.0	7 70.0 20.0	10 21.3
7 to 12	2	6 28.6 50.0	15 71.4 42.9	21 44.7
13 to 18	3	3 18.8 25.0	13 81.3 37.1	16 34.0
	Column Total	12 25.5	35 74.5	47 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
.59409	2	.7430	2.553	2 OF 6 (33.3%)

Statistic	Value	Significance
Cramer's V	.11243	

Number of Missing Observations = 0

APPENDIX 6 (contd.)

Crosstabulation: ESCORE GEFT Score
 By STM3 C.S. better suited to males

STM3→	Count Row Pct Col Pct	Agree st rongly 1	Disagree 3	Row Total
ESCORE				
0 to 6	1	1 10.0 20.0	9 90.0 21.4	10 21.3
7 to 12	2	3 14.3 60.0	18 85.7 42.9	21 44.7
13 to 18	3	1 6.3 20.0	15 93.8 35.7	16 34.0
	Column Total	5 10.6	42 89.4	47 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
.62227	2	.7326	1.064	3 OF 6 (50.0%)

Statistic	Value	Significance
Cramer's V	.11506	

APPENDIX 6 (contd.)

Crosstabulation: ESCORE GEFT Score
 By STM4 C.S. best for Science/
 Engineering

STM4→	Count Row Pct Col Pct	Agree st rongly 1	Disagree 3	Row Total
ESCORE				
0 to 6	1	3 30.0 16.7	7 70.0 24.1	10 21.3
7 to 12	2	9 42.9 50.0	12 57.1 41.4	21 44.7
13 to 18	3	6 37.5 33.3	10 62.5 34.5	16 34.0
	Column Total	18 38.3	29 61.7	47 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F.< 5
.48042	2	.7865	3.830	1 OF 6 (16.7%)

Statistic	Value	Significance
Cramer's V	.10110	

Number of Missing Observations = 0

APPENDIX 6 (contd.)

Crossstabulation: ESCORE GEFT Score
 By STM5 C.S. best for Business

STM5→	Count Row Pct Col Pct	Agree st rongly 1	Disagree 3	Row Total
ESCORE				
0 to 6	1	4 40.0 19.0	6 60.0 23.1	10 21.3
7 to 12	2	9 42.9 42.9	12 57.1 46.2	21 44.7
13 to 18	3	8 50.0 38.1	8 50.0 30.8	16 34.0
	Column Total	21 44.7	26 55.3	47 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
.30005	2	.8607	4.468	1 OF 6 (16.7%)

Statistic	Value	Significance
Cramer's V	.07990	

Number of Missing Observations = 0

APPENDIX 6 (contd.)

Crosstabulation: ESCORE GEFT Score
 By STM6 Flowchart required

STM6→	Count Row Pct Col Pct	Agree st rongly 1	Disagree 3	Row Total
ESCORE				
0 to 6	1		10 100.0 23.3	10 21.3
7 to 12	2	3 14.3 75.0	18 85.7 41.9	21 44.7
13 to 18	3	1 6.3 25.0	15 93.8 34.9	16 34.0
	Column Total	4 8.5	43 91.5	47 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
1.93475	2	.3801	.851	3 OF 6 (50.0%)

Statistic	Value	Significance
Cramer's V	.20289	

Number of Missing Observations = 0

APPENDIX 6 (contd.)

Crosstabulation: ESCORE GEFT Score
 By STM7 Stick to the flowchart

STM7→	Count Row Pct Col Pct	Agree st rongly 1	Disagree 3	Row Total
0 to 6	1		10 100.0 22.7	10 21.3
7 to 12	2	2 9.5 66.7	19 90.5 43.2	21 44.7
13 to 18	3	1 6.3 33.3	15 93.8 34.1	16 34.0
	Column Total	3 6.4	44 93.6	47 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
1.02897	2	.5978	.638	3 OF 6 (50.0%)

Statistic	Value	Significance
Cramer's V	.14796	

Number of Missing Observations = 0

APPENDIX 6 (contd.)

Crosstabulation: ESCORE GEFT Score
 By STM8 Try out different approaches

STM8→	Count Row Pct Col Pct	Agree st rongly 1	Disagree 3	Row Total
ESCORE				
0 to 6	1	9 90.0 24.3	1 10.0 10.0	10 21.3
7 to 12	2	16 76.2 43.2	5 23.8 50.0	21 44.7
13 to 18	3	12 75.0 32.4	4 25.0 40.0	16 34.0
	Column Total	37 78.7	10 21.3	47 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
.97206	2	.6151	2.128	3 OF 6 (50.0%)

Statistic	Value	Significance
Cramer's V	.14381	

Number of Missing Observations = 0

APPENDIX 6 (contd.)

Crosstabulation: ESCORE By STM9 GEFT Score
Change approach if needed

STM9→	Count Row Pct Col Pct	Agree st rongly 1	Disagree 3	Row Total
ESCORE				
0 to 6	1	9 90.0 22.0	1 10.0 16.7	10 21.3
7 to 12	2	16 76.2 39.0	5 23.8 83.3	21 44.7
13 to 18	3	16 100.0 39.0		16 34.0
	Column Total	41 87.2	6 12.8	47 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F.< 5
4.71001	2	.0949	1.277	3 OF 6 (50.0%)

Statistic	Value	Significance
Cramer's V	.31656	

Number of Missing Observations = 0

APPENDIX 6 (contd.)

Crosstabulation: ESCORE GEFT Score
 By STM10 No new commands without advice

STM10→	Count Row Pct Col Pct	Agree st rongly 1	Disagree 3	Row Total
ESCORE				
0 to 6	1	7 70.0 26.9	3 30.0 14.3	10 21.3
7 to 12	2	11 52.4 42.3	10 47.6 47.6	21 44.7
13 to 18	3	8 50.0 30.8	8 50.0 38.1	16 34.0
	Column Total	26 55.3	21 44.7	47 100.0

<u>Chi-Square</u>	<u>D.F.</u>	<u>Significance</u>	<u>Min E.F.</u>	<u>Cells with E.F.< 5</u>
1.12848	2	.5688	4.468	1 OF 6 (16.7%)

<u>Statistic</u>	<u>Value</u>	<u>Significance</u>
Cramer's V	.15495	

Number of Missing Observations = 0

APPENDIX 6 (contd.)

Crosstabulation: ESCORE GEFT Score
 By STM11 Computers have no intelligence

STM11→	Count Row Pct Col Pct	Agree st rongly 1	Disagree 3	Row Total
ESCORE				
0 to 6	1	5 50.0 13.9	5 50.0 45.5	10 21.3
7 to 12	2	18 85.7 50.0	3 14.3 27.3	21 44.7
13 to 18	3	13 81.3 36.1	3 18.8 27.3	16 34.0
	Column Total	36 76.6	11 23.4	47 100.0

<u>Chi-Square</u>	<u>D.F.</u>	<u>Significance</u>	<u>Min E.F.</u>	<u>Cells with E.F.< 5</u>
5 .11307	2	.0776	2.340	3 OF 6 (50.0%)

<u>Statistic</u>	<u>Value</u>	<u>Significance</u>
Cramer's V	.32983	

Number of Missing Observations = 0

APPENDIX 7

Subjects most liked/disliked by sex

Crosstabulation: LIKE Subjects enjoyed most
 By SEX Respondent's sex

SEX→	Count		Male	Female	Row Total
	Row Pct	Col Pct	1	2	
LIKE					
	1		9	4	13
Maths/Science			69.2	30.8	27.7
			40.9	16.0	
	2		2	2	4
Arts			50.0	50.0	8.5
			9.1	8.0	
	3		6	7	13
Computer studies			46.2	53.8	27.7
			27.3	28.0	
		Column Count	22	25	47
SEX→	Row Pct	Col Pct	Male	Female	Row Total
LIKE			1	2	
	4		3	6	9
Business			33.3	66.7	19.1
			13.6	24.0	
	5			1	1
				100.0	2.1
				4.0	
	8		2	5	7
No answer			28.6	71.4	14.9
			9.1	20.0	
	Column Total		22	25	47
			46.8	53.2	100.0

APPENDIX 7 (contd.)

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
5.11507	5	.4020	.468	8 OF 12 (66.7%)
Statistic			Value	Significance
Cramer's V			.32990	

Crosstabulation: DISLIKE Subjects enjoyed least
By SEX Respondent's sex

SEX→	Count	Male	Female	Row Total
	Row Pct	1	2	
	Col Pct			
DISLIKE				
1	6	6	12	
Maths/Science	50.0	50.0	25.5	
	27.3	24.0		
2	8	4	12	
Arts	66.7	33.3	25.5	
	36.4	16.0		
3	2	6	8	
Computer studies	25.0	75.0	17.0	
	9.1	24.0		
	Column Count	22	25	47
SEX→	Row Pct	Male	Female	Row Total
	Col Pct	1	2	
DISLIKE				
4	2	1	3	
Business	66.7	33.3	6.4	
	9.1	4.0		
8	4	8	12	
No answer	33.3	66.7	25.5	
	18.2	32.0		
	Column Total	22	25	47
		46.8	53.2	100.0

APPENDIX 7 (contd.)

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F.< 5
4.82818	4	.3054	1.404	4 OF 10 (40.0%)

Statistic	Value	Significance
Cramer's V	.32051	

Number of Missing Observations = 0

Crosstabulation: LIKE Subjects enjoyed most
By SEX Respondent's sex

SEX→	Count Row Pct Col Pct	Male	Female	Row Total
		1	2	
LIKE				
Maths/Science	1	9 69.2 40.9	4 30.8 16.0	13 27.7
Arts	2	2 50.0 9.1	2 50.0 8.0	4 8.5
Computer studies	3	6 46.2 27.3	7 53.8 28.0	13 27.7
		22	25	47
SEX→	Column Count Row Pct Col Pct	Male	Female	Row Total
LIKE		1	2	
Business	4	3 33.3 13.6	6 66.7 24.0	9 19.1
	5		1 100.0 4.0	1 2.1
No answer	8	2 28.6 9.1	5 71.4 20.0	7 14.9
	Column Total	22 46.8	25 53.2	47 100.0

APPENDIX 7 (contd.)

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
5.11507	5	.4020	.468	8 OF 12 (66.7%)
Statistic			Value	Significance
Cramer's V			.32990	

Crosstabulation: DISLIKE Subjects enjoyed least
By SEX Respondent's sex

SEX→	Count		Male	Female	Row Total
	Row Pct	Col Pct	1	2	
DISLIKE					
Maths/Science	1		6 50.0 27.3	6 50.0 24.0	12 25.5
Arts	2		8 66.7 36.4	4 33.3 16.0	12 25.5
Computer studies	3		2 25.0 9.1	6 75.0 24.0	8 17.0
		Column Count	22	25	47
SEX→	Row Pct	Col Pct	Male	Female	Row Total
DISLIKE			1	2	
Business	4		2 66.7 9.1	1 33.3 4.0	3 6.4
No answer	8		4 33.3 18.2	8 66.7 32.0	12 25.5
		Column Total	22	25	47
			46.8	53.2	100.0

APPENDIX 7 (contd.)

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
-----	-----	-----	-----	-----
4.82818	4.	.3054	1.404	4 OF 10 (40.0%)
	Statistic		Value	Significance
	-----		-----	-----
Cramer's V			.32051	
Number of Missing Observations =			0	

THE APPLICATION OF INFORMATION TECHNOLOGY
IN THE CARIBBEAN:
THE CASE OF AQUACULTURE JAMAICA LIMITED

A Research Paper

Submitted in Partial Fulfillment of the Requirements for
the Degree of Master of Science in
Development Studies

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The University of the West Indies

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ABSTRACT

The Application of Information Technology in the Caribbean:
The Case of Aquaculture Jamaica Limited.

Sheldon Daniel

Information Technology (IT) is being used globally to confer new competitive advantages on developing countries. In Caribbean countries, while utilization of IT has been gradually increasing, analysis and investigation into firm level application is lacking. This study attempts to identify and analyze the critical variables that affected, and continue to affect, the utilization of IT at Aquaculture Jamaica Ltd. Data was collected data mainly using interviews (formal and informal) with the persons involved in the planning and use of the technology.

A detailed examination of the Pond Management\Accounting System illustrates the manner in which the system is used to aid in fish production and provides insights into the benefits accruing to the users of the system. The majority of the analysis concentrates on the identification of the critical variables, categorized as facilitators or inhibitors, that have impacted on the utilization of the IT effort.

The major finding of the study was that effort was facilitated by strong support from the critical stakeholders involved: Top management, the technical staff and the users operating within an organizational culture that fostered innovation. These factors, in the short term, promoted IT utilization and user support. There are problems existing (lack of documentation of systems and informal approach to systems development and planning) which can be expected to inhibit the long term development of the system. There is also the conclusion that the IT application process should be dynamic, always taking cognisance of the organizational environment within which implementation is occurring.

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SECTION 1

INTRODUCTION

Caribbean economic development continues to be elusive. Development in recent times has been retarded by two main factors: a) huge debt burdens and b) production structures that lack dynamism due to demand and supply constraints. These constraints have been created either by poor export market prospects, high production costs or resource depletion (McIntyre, 1989: 8). The consequent impact on the local economy has been increased unemployment, poverty and social malaise. Trends in the global economy, such as the emergence of the Pacific rim as the new international growth centre, suggest that there needs to be an improvement in the region's international competitiveness, a conscious development of new products and substantial improvements in Caribbean export marketing (Bourne, 1988: 117). These requirements can be facilitated by a judicious use and application of newly emerging micro electronic (ME) technologies that are revolutionizing the way humankind works and interacts generally. This new technology offers the possibility of creating competitive advantage "by lowering cost and increasing product and service differentiation in almost all industry sectors" (Kheng Hwa, 1990: 17).

The revolution in micro electronic technology in the late 1960's allowed for the storage, transmission and processing of vast quantities of information via artificial means to a degree never before possible. Since the operations by which most products are manufactured involve the processing and communication of information, then the "potential for applying ME devices and products to industry and services throughout the whole economy is virtually limitless" (Girvan, 1989; 118). Technologies that exploit this innovation are termed Information Technologies.

Information Technology (IT) refers to that form of non-human resources that exploit modern data processing, storage, retrieval and communication systems in the processing, storage and communication of information. IT also refers to the way in which these resources are combined to manage and perform a particular set of tasks (King and Grover; 1991, 294 ; Antonelli, 1991; 33). In most parts of the world, IT has been impacting on almost every sphere of human activity. In production, electrical parts are being replaced by electronic components and, as in the case of the word processor, new capabilities are being integrated into old products. The production process has also changed since Computer Aided Manufacturing (CAM)

and Computer Aided Design (CAD) have increased the flexibility, adaptability and economy of production as skills can now be incorporated into the equipment, and capital savings accrue because of greater resistance to obsolescence. In the office, improvements occur in the automation of routine clerical work as well as the increased effectiveness and efficiency of organizational communications. Services have now become easily transportable and new services, like Data Entry services, have grown rapidly. (Rada, 1985; 573-574).

1.1 Global Diffusion of IT

The advances in the application of IT have continued at a rapid pace and continues to do so, given that IT systems are now getting smaller, cheaper and more powerful with a continuous stream of new IT products appearing on the market (Kheng Hwa, 1990: 17). The developed countries have been the leaders in IT application while the developing world has tended to lag in using the new technology (Mody and Dahlman, 1992: 1708).

1.1.1 IT application in the Developed Countries

Application in the developed world has been well documented. King and Grover (1991: 298) in a general report on IT application in the United States, have identified six areas of application of the technology: customer service, supplier relations, product/service differentiation, cost competitiveness, new product planning and market segmentation. Generally, the main users of IT have been those sectors that are most information intensive. Therefore, the financial sector, particularly banks, and the retail and wholesale sectors have been leaders in application. Business services (eg. advertising, accounting, airline computer reservations) are also major users of the new technology and growth in these activities has been facilitated by modern IT infrastructure. This is illustrated by the increase in business services which in the United States, grew by almost 50% a year during the period 1975-87 from about \$3 billion to \$130 billion (Mody and Dahlman, 1992: 1705-1707). Some of these services (such as the automated bank tellers) have been created only due to the existence and proliferation of the IT infrastructure.

In manufacturing, the application, while increasing, is not as pervasive as application in the service sector. One application, Computer Aided Design (CAD), has now become widely used, reducing design times and thereby the time a new product takes to be introduced to the market. As the technology becomes cheaper, and the software packages that are developed become more sophisticated, then

application in manufacturing processes can be expected to increase.

1.1.2 IT Diffusion in the Developing Countries

In the developing countries the evidence is quite deficient and what does exist suggest that IT diffusion is not quite widespread. Generally, the governments of developing countries are the major users of IT in the early phases of the drive towards computerization (Mody and Dahlman, 1992: 1709). Application in the private sector is mainly in the service industries, especially by banks and other financial institutions.

Use of IT is greatest amongst the Newly Industrialized Countries (NIC's). Singapore has gone the furthest in using the technology with 59% of companies with 10 employees or more using computers (Kheng Hwa, 1990: 17). The *World Competitiveness Report* of 1990 gave Singapore the top placed ranking for the extent to which computer based IT is effectively used and also the number of top managers understanding and using IT (cited in Seng Hon, 1992: 1817). Table 1.1 shows the sectoral utilization of IT in Singapore.

TABLE 1.1

IT USAGE BY SECTOR IN SINGAPORE. 1985, 1987

Sector	IT Usage (1985)%	IT Usage (1987)%
Manufacturing	41	52
Commerce	43	53
Transport	48	61
Finance	78	85
Community	47	58
Construction	50	61
Others	41	52

Source: National Computer Board IT Survey, 1987
(cited in Kheng Hwa, 1990: 18).

It is noted from Table 1.1 that application in 1987 is furthest in the financial sector and all other sectors have at least 50% or more of the firms in that sector using IT. South Korea and Taiwan, two other NIC's, are extremely advanced in their application of IT but lag behind

Singapore in the extent of their application (Mody and Dahlman, 1992: 1709).

IT application in the Caribbean has also been increasing. Studies done by Marcelle (1991) on the Computer Services industry in Jamaica and by NIHERST (1989) on the computer supply industry in Trinidad and Tobago suggest that the use of computers and peripherals in the respective economies have been escalating, both in public and private organizations. NIHERST noted that application is mainly in the service sector and was utilized mostly for data processing (accounting, personnel records) and control systems (NIHERST, 1989: 23-24). Another study found that computer application in Jamaica has been increasing, mainly in the area of "accounting, office automation and administrative systems" (Marcelle, 1991: 2).

1.2 The Research Problem

This increased utilization, however, has not been accompanied by adequate study of the application process and the process of adoption of the technology in particular firms and countries. This dearth of research has left a void in the understanding of the process of utilization and some of the issues and problems that emerge in attempting to utilize Information Technology at the firm level. This paper will attempt, albeit in a preliminary manner, to fill this void.

Given this general aim, the paper will therefore seek to explore some issues (both within the organisation and in the external environment) that arise out of an attempt to apply Information Technology in one organization. Using data collected from Aquaculture Jamaica Ltd., a member of the Jamaica Broilers Group of Companies, the paper will be used to indicate the variables that can be considered critical when attempting to use the technology. These will be grouped as either facilitators or inhibitors towards the effort to utilize IT. From this, policy initiatives and future research areas can be proposed to increase the effectiveness of the use of IT in firms in the country.

1.3 Justification and Rationale for of the Study

a) Given the paucity of research on the area, the study will make an academic contribution by providing a preliminary insight into conceptual and organizational issues that may be critical in firm level IT application. It will be exploratory, merely able to suggest theoretical propositions on IT application in the Caribbean which can be more rigorously tested by future research.

b) The few studies done on the utilization of IT in the Jamaica have tended to be wide in focus, looking at industry use and supply. There is need for more in-depth "micro study", like the present and the study recently done by Girvan and Marcelle et al.(1993), to provide insights into IT efforts of individual firms.

c) The study will also be useful to organizational users of IT in Jamaica as an example of some of the issues and problems that can be encountered when planning and implementing an Information system.

d) The study will be able to suggest areas that public policy, through a national science and technology policy, can address so as to ensure that the advantages of IT can be realized and used as a national development tool.

The plan of the paper is as follows. Proceeding from the introduction is Section Two with a review of the previous literature and research findings which are relevant to the research problem. Section Three provides background information on firm selection, a brief history and profile of the Jamaica Broilers Group of Companies and of Aquaculture Jamaica Ltd. Section Four details the methodology used for the research and some issues emerging from the research process. The major findings are analyzed in Section Five. Included are a description of the systems in use, the gains that have accrued to the users of the system and some of the factors that have inhibited or promoted the IT application effort. A discussion of the main points of the research and recommendations for future research and possible policy interventions will conclude the paper.

SECTION 2

LITERATURE REVIEW

Examination of the literature which deals specifically with the application and implementation of IT provides a description and analysis of the process mainly using examples and assumptions that are relevant to developed countries. While these are useful, the lack of examples from the developing world makes it difficult to gauge whether these factors identified in developed countries are applicable in the developing context. Also the developing countries that have been extensively investigated are mainly the East Asian countries, especially Singapore, where the levels of usage of IT are comparable to the developed countries. Data on efforts in other developing countries are sparse.

The present study can be subsumed under the category of *Implementation Analysis*. According to Girvan, this portion of the literature deals with the factors that impede or facilitate the successful utilization of IT (Girvan, 1992: 1). All of the literature discussed below either look at variables that impact on a number of efforts or the role individual variables can be expected to play in the implementation effort.

2.1 Critical Factors which Impact on IT

One study found that the reasons for unsuccessful implementation in 25 companies, which were listed in the Fortune 500, were associated with organizational, and not technical errors (Crescenzi, 1988: 14-20). In a major review, King and Grover (1991) have identified a range of organizational inhibitors and facilitators which affect the deployment of IT and are listed in Table 2.1.

TABLE 2.1

LIST OF ORGANIZATIONAL FACILITATORS AND INHIBITORS IN IT APPLICATIONS

Facilitators	Inhibitors
1. Strong Market position	1. Lack of appropriate planning
2. Existing IT leadership	2. Low perceived importance of concept
3. Strong Planning capability of firm	3. Lack of appropriate technical support
4. Extensive computer facilities	4. Budgetary constraints
5. Strong organization /Top management support	5. Difficulty in assessing tangible contributions
6. Pressure from competition	6. Complexity of the concept
7. Strong technical support/ expertise in the firm	7. High potential start up difficulties
8. Strong financial position	8. Lack of top management support
9. Need for uniqueness or innovation	9. Power and politics in the Firm
	10. Nature of external environment
	11. Ill defined Management Objectives
	12. Other priorities

(Source: King and Grover, 1991: 297)

The study found that the major overall facilitators were strong technical support, infrastructure and competitive pressure, while the lack of appropriate planning, lack of top management support and the difficulty in assessing tangible contributions were the major inhibitors (King and Grover, 1991: 300). The literature thus suggests organizational variables found to be critical in analyzing the utilization of IT in the particular firm and so can be used by this research.

The literature emerging from the developing countries also suggest factors that have impacted on IT implementation. Singapore, with its extensive use of IT, has annual surveys done on IT utilization in the society. Kheng Hwa, using these surveys, has identified some of the factors that impede the utilization of the technology in Singapore. Table 2.2 shows the problems small companies encountered in the application of IT.

TABLE 2.2

**PROBLEMS IN APPLICATION OF IT
IN SMALL COMPANIES IN SINGAPORE**

Problems Encountered	Frequency of Problem (%)
Long Learning Curve of Users	46
Unsuitable Hardware or Software	31
Perceived Shortage of IT Professionals & Solutions	27
Operator, Hardware or Mechanical Problems	27

Source: NCB IT Awareness Survey, 1988. (cited in Kheng Hwa, 1990: 22)

Table 2.2 highlights the point that the users of the system can have a major impact on the utilization of the IT process. Overall, Kheng Hwa found that the main impediments to IT use amongst businesses were:

- a) *High cost of systems,*
- b) *Inadequate technical expertise and manpower,*
- c) *Difficulty in selecting the right IT solution,*
- d) *Insufficient management support and commitment,*
- e) *Lack of awareness on the business use of IT.*

(Kheng Hwa, 1990: 21)

These factors are similar to those noted above with the exception of the high cost of the system. This difference may be explained by the size of the firms in Singapore survey, which appear generally to be small and therefore the initial investment in IT may be, relative to total sales and expenditure, higher compared to the larger companies in the developed world. The cost factor will therefore become more important in such situations.

The studies from the developed world make assumptions that may not necessarily hold in the developing world. This is illustrated by a study of informatics in Africa. This study examined 76 World Bank supported, IT projects in Africa and attempted to identify the core factors that may lead to problems in implementation. Areas of application included education, agriculture and public sector management. In the majority of cases, the implementation was inefficient and the technology not used effectively. The core factors identified as contributing to the failure were:

- 1) *Institutional factors - insufficient planning, lack of management commitment to informatics program, unclear objectives and priorities,*
- 2) *Human Resources - Shortage of qualified persons, inadequate compensation of technical staff, high turnover of technical and competent managerial staff,*
- 3) *Funding - Underestimated project costs, Lack of recurrent expenditure,*
- 4) *Local environment - Lack of backup equipment and spares, inadequate site preparation and,*
- 5) *Technology and Information changes - Limited hardware and software availability, inappropriate software (Moussa & Schwere, 1992: 1743)*

The study of IT applications in the developing countries need to include a broader range of variables than those considered in the industrialized world. For example, the literature coming out of developed countries appear to take as given the provision of basic physical infrastructure such as electricity and telephone services. In the case of Africa, one of the problems encountered was insufficient provision of the necessary physical infrastructure. Similarly, software and hardware availability, while not critical in industrialized countries, have been mentioned in the African and the Singapore context. The search for IT impact factors in the developing countries will have to be cognizant of the wider external physical and social environment in which the technology is being applied.

Some literature on the Caribbean application is available. A recent investigation by Girvan & Marcelle, et al.(1993) into the sources and applications of the technology in the Caribbean provided information on the constraints to application as perceived by the firms. The three leading problems were as follows:

- 1) *the cost of application of IT,*
 - 2) *the unavailability of skilled labour and,*
 - 3) *unreliable public utilities.*
- (Girvan & Marcelle, et al, 1993: 109)

These problems appear similar to those discussed in Africa and in Singapore and point to the main problem apparently facing the developing world in utilizing the technology: the lack of indigenous IT capability and the scarcity of the human and physical infrastructure needed for application of the technology.

2.2 Research on Specific Variables that Impact on IT Application

Some of the variables mentioned as critical factors have been given in-depth treatment in the literature. One such factor has been the impact of the Chief Executive Officer (CEO) on the implementation effort. One study by Jarvenpaa and Ives (1991) investigated the role of executive support in the management of IT. Executive support was operationalised in two ways; executive participation and executive involvement. Executive involvement referred to the psychological state of the CEO, reflecting the degree of importance which the CEO places on IT. The involved CEO, while not actively participating in managing the IT system, views the system as vital to the firm's success. Executive participation entails the active commitment and intervention of the CEO in the effort, including activities such as chairing the IT committee and overseeing projects. Data were collected from CEO's in the United States by a mail survey. Eighty three questionnaires were sent out and fifty seven (69%) replied.

The results suggested that executive involvement is important. The CEO does not need to be personally participative but rather "if the firm is to be progressive in its use of IT, the CEO must send the right supportive signals regarding IT to his or her organization" (Jarvenpaa & Ives, 1991: 219).

User involvement has also been investigated. One study (Hawk & Dos Santos, 1991: 316-327) operationalised user involvement in two ways: user participation and user

leadership. User participation involves activities such as working with IS professions in determining system requirements and developing and evaluating systems design. User leadership refers to the leadership of the IS development team; planning, coordinating and controlling the activities in the development process. The systems were categorized as either decision support or transaction processing systems. Decision support systems were those used to generate reports, inquiries or model based analyses. Transaction processing systems were those systems used mainly for data entry or processing transactions. The data were collected from 51 information systems in 18 organizations.

The study found that user involvement (of both types) increased support for the system only under certain situational factors. User involvement increases support for the system when the system is used for decision support. The possible reason given for this is that in such systems, the user requirements can only be obtained from the user; user participation therefore ensures that the systems are better designed to meet the needs of the users. Transaction processing systems can, and usually are, designed via observation or review of existing systems, with less user involvement and higher possibility of systems that are irrelevant to the users.

The study also found that the organizational status of the users is an important variable. "Increasing participation and leadership by high level managers positively affected user information satisfaction" (Hawk & Dos Santos, 1991: 325). This may be explained by the fact that users at this level are better equipped in terms of leadership skills and organizational knowledge and therefore may participate more effectively.

The role and the structure of the IS department has also been investigated. A study by Hodgkinson (1992) investigated the manner in which the IT function was organized in large multi-business companies. The four IT structures that were examined were: Centralized, Centralized hybrid (Strategic Leadership), decentralized hybrid (Strategic Guidance) and the decentralized structure. In centralized structures only 10-15% of the IT management is devolved. Strategic Leadership refer to those IT structures in which around 50% of the IT responsibility is devolved with the centre retaining the dominant influence. In Strategic Guidance, about 70-80% of the IT responsibility is devolved. Using data from 50 companies in the United Kingdom, collected using a mail questionnaire, the author found that the predominant form of IT management was a federal structure (strategic leadership or strategic guidance). Strategic leadership

were present in 50% of the companies while 38% of the respondents had a strategic guidance. The study indicated that IT management style is closely related to the overall management style of the company (Hodgkinson, 1992:161-173).

Another issue that arose from the literature on IT application is the consistent lack of quantification of the benefits or gains (or losses for that matter) of the IT effort. The literature on IT indicated that the productivity gains accruing due to the use of IT were, in many instances, difficult to establish. This has led researchers to use various indirect proxies that have been either vague or their relationship to the effort questionable. For example, the one study carried out by Jarvenpaa and Ives proposed and provided support for the counting of IT related phrases in the chairman's letter as a measure of the state of IT use in the firm (reported in Jarvenpaa and Ives, 1991: 214). A study on the Jamaican situation noted that none of the firms that were interviewed had included the requirement of quantification of the benefits derived from the technology, with one firm suggesting that the IT investment was based on intuitive knowledge of the gains to be had by using IT (Girvan & Marcelle, et al, 1993: 108). Quantification of gains therefore appears to be another important issue in examining an IT effort.

From the literature emerges some critical IT factors to be considered in IT application: top management support, user involvement and the existence of strong technical support for the effort. The presence of these factors should facilitate utilization, while their absence can lead to inefficient use of IT. The brief review also indicates that a variety of factors external to the organization could affect the utilization of IT in a developing country like Jamaica. This study will therefore attempt to establish whether the effort at Aquaculture Jamaica Ltd. supports or refutes this evidence presented in the literature.

SECTION 3

BACKGROUND

3.1 Firm Selection

The choice of a company to research can be fraught with compromise and disappointment. In the main, the researcher has to ensure that the chosen company is

relevant to the issue (application and utilization of IT) under examination. The researcher used the requirement that the company chosen should be using IT for a period of about 3-5 years ensuring a system that has been fully implemented and operational. This, however, has to be balanced against a number of other factors that are discussed below.

Firstly, there was the requirement that the activities of the company were of such a nature as to contribute positively to the national development effort of Jamaica. While this is highly subjective, and will in part be conditioned by ideology, it was viewed as necessary given

the nature of the degree for which the paper is to be submitted. Secondly, and at a more practical level, one is constrained by the company's willingness to be researched. The researcher basically requests of the case study organization to "bare all". This can be intimidating, as well as risky, from the company's point of view, since this means permitting access to sensitive information which could be used in various other (less noble?) endeavors. Management receptivity was seen as critical to the researcher's successful investigation. Thirdly, and less importantly, a company with which the researcher was able to use prior existing contacts, or those established by other members of faculty, would greatly aid in the process of gaining access into the organization.

Initially the research was to have taken place in Trinidad and Tobago. Firms approached were apprehensive; wary of the purpose to which the information obtained could be used. The two companies considered as being relevant to the study did not allow entry for investigation. Jamaica Broilers Group Limited then was approached and permission was granted for the study to proceed. This company adequately fulfilled the requirements stated above as 1) the IT effort has been continuous and operational for over 4 years; 2) top management appeared very willing to cooperate and facilitate the study; and 3) the activities of the group exhibited high levels of innovativeness and creativity which suggested that this could be an example from which other firms in the Jamaica could learn. Also there was access to the senior management which facilitated quick feedback. Thus the decision to make the group (or a subsidiary therein) the subject of the research.

3.2 The Group: Jamaica Broilers Group Limited

Jamaica Broilers Group Limited is an integrated group of agribusiness divisions, subsidiaries and associated companies with assets of over \$700 million and turnover of

one billion dollars as of 1992¹. The corporate structure is shown as Appendix 2. Group profits and turnover are shown in Fig 3. 1(a) & (b) respectively.

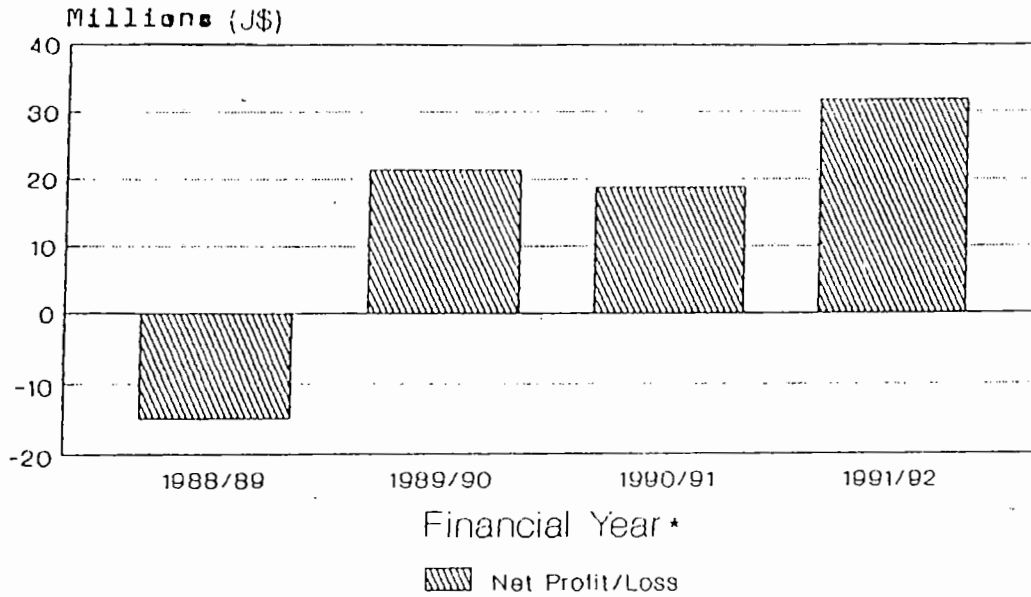
The company was formed in 1958 and was at that time involved in the production of broiler (poultry) meat. Jamaica Broilers began in the business of growing and selling chicken and most of the company's growth since has reflected attempts to capture the gains from vertical integration in the industry. At present, broiler production remains the dominant activity, with Jamaica Broilers producing about 50% of the industry.² However, the company is also involved in a range of broiler related activities. These include the production of fertile eggs from which the chicks are hatched and transported to contract farmers. The processing of the grown chickens is performed by the company. All of these operations are owned by the company. Even the major animal feed mill in the island is owned by the company.

More recently the company has become involved in the production of other types of meats. Beef production, while not as important to the group as the chicken activities, has been added to the activities of the group. The group has more recently involved itself in the production of another form of protein - fish. The move has its motivation in two factors: a) the group felt that the expertise gained in the production of meat and fish would aid in the development of the fish production technology and b) fish held good export potential and was therefore considered a source of foreign exchange. The company responsible for the fish production is Aquaculture Jamaica Limited.

¹ Jamaica Broilers Group Limited Prospectus 1992 Share Issue. p 10.

² M. Witter The Poultry Industry in Jamaica: The Impact of the Reform of the Common External Tariff (CET). Unpublished Paper. Consortium Graduate School, 1992. p 3.

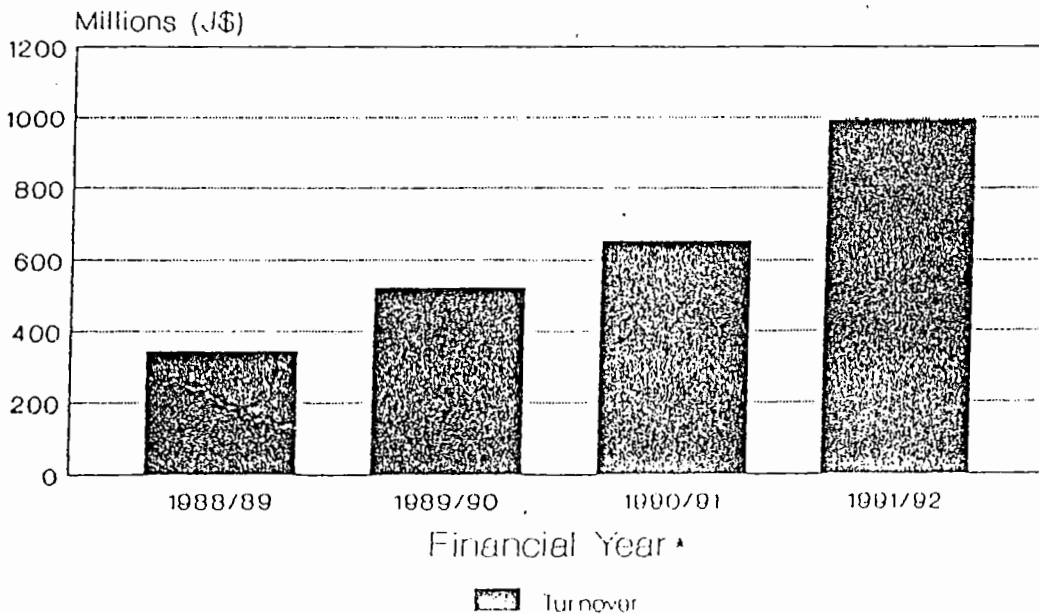
Fig. 3.1(a). Net Profit and Loss,
Jamaica Broilers Group Ltd.
(1988-1992)



*Financial Year runs from May 1-April 30

Source: Prospectus: 1992 Share Issue,
Jamaica Broilers Group Ltd.

Fig. 3.1(b) Turnover
Jamaica Broilers Group Ltd.
(1989-1992).



*Financial Year runs from May 1-April 30

Source: Prospectus: 1992 Share Issue,
Jamaica Broilers Group Ltd.

3.3 The Subsidiary: Aquaculture Jamaica Limited

Aquaculture Jamaica Limited³ is the largest private producer of fresh water fish in the country. The type of fish that is reared is called the "Red Talapia". This fish is pink in colour which has been found to be appealing in the foreign markets. The two production facilities (one at Toll Gate, Clarendon and the other at Barton Isles (Brumdec), St Elizabeth) utilizes 205 acres of ponds in production. Annual total sales as represented in Fig. 3.2.(a) illustrates that sales revenue has been increasing over the past four financial years.⁴ This can, in the main be explained by an increase in the price of fish since Fig 3.2.(b) shows that total output slightly increased for the first three years under consideration and in fact is below the 1991-92 total for the first 11 Periods of the financial year 1992-93 (Refer to Appendix 1).

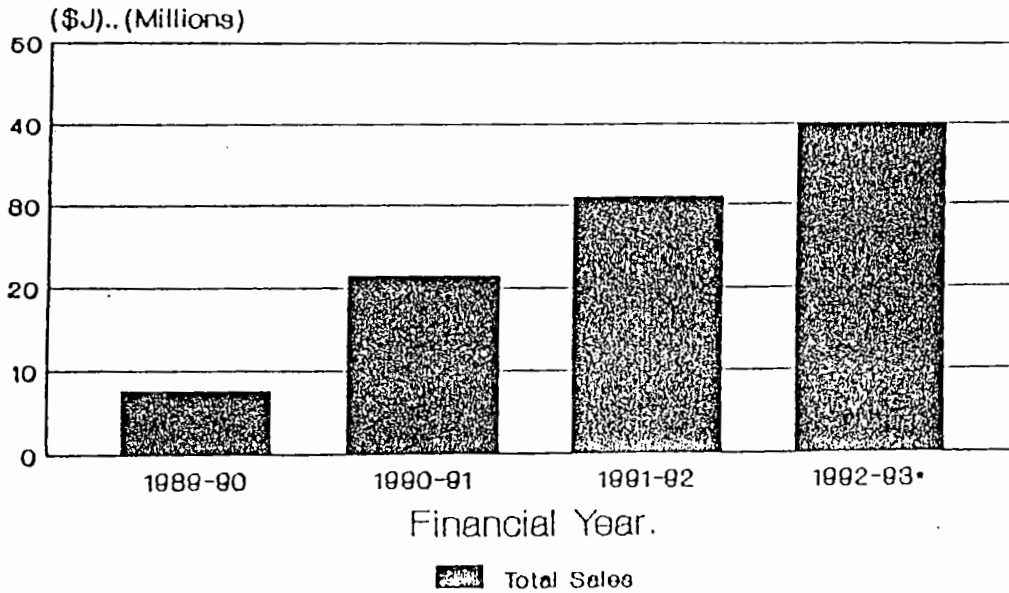
Fig 3.2.(c) shows the Net Profit/Loss position of the company for the past four years. Except for the financial year 1992-1993, the company experienced increasing profits. The loss accruing in the most recently ended financial year 1992-1993, is mainly due to increased cost, both in production and overheads. Production cost increases have resulted mainly from rising feed cost which lead to increased unit cost. The reason for a larger overhead cost could not be ascertained. The loss has prompted the company to undertake major staff reorganization and restructuring.

Aquaculture Jamaica Ltd. was established in 1984. The main production facility is located at Brumdec, St. Elizabeth, next to the Black River. The initial production focus was shrimp. Since the production was not common in the island, even the region, the directors of the company turned to the Israelis (who were familiar with the technology) to provide the supporting physical infrastructure that was necessary for the shrimp production.

³ For the remainder of the paper, the company Aquaculture Jamaica Ltd. will be referred to as Aquaculture.

⁴ The information contained in this section (unless otherwise stated) has been obtained from the official financial statements of the company and from interviews with various members of staff.

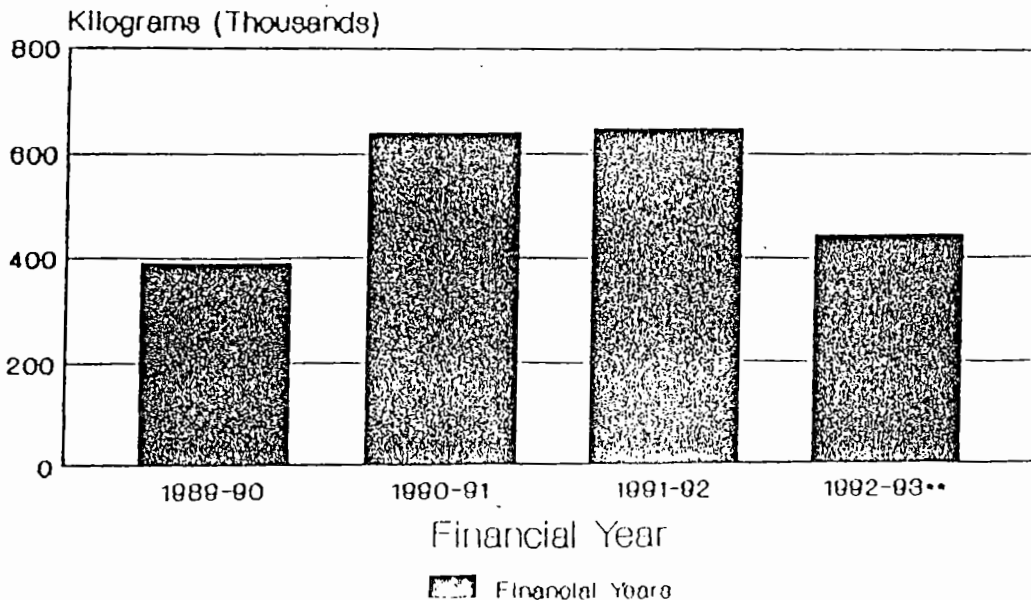
**Fig 3.2 (a) Total Fish Sales,
Aquaculture Jamaica Ltd.
(1989-1993).**



Source: Financial Statements of
Aquaculture Jamaica Ltd.
Various Years.

* Includes Sales up to Period 49.

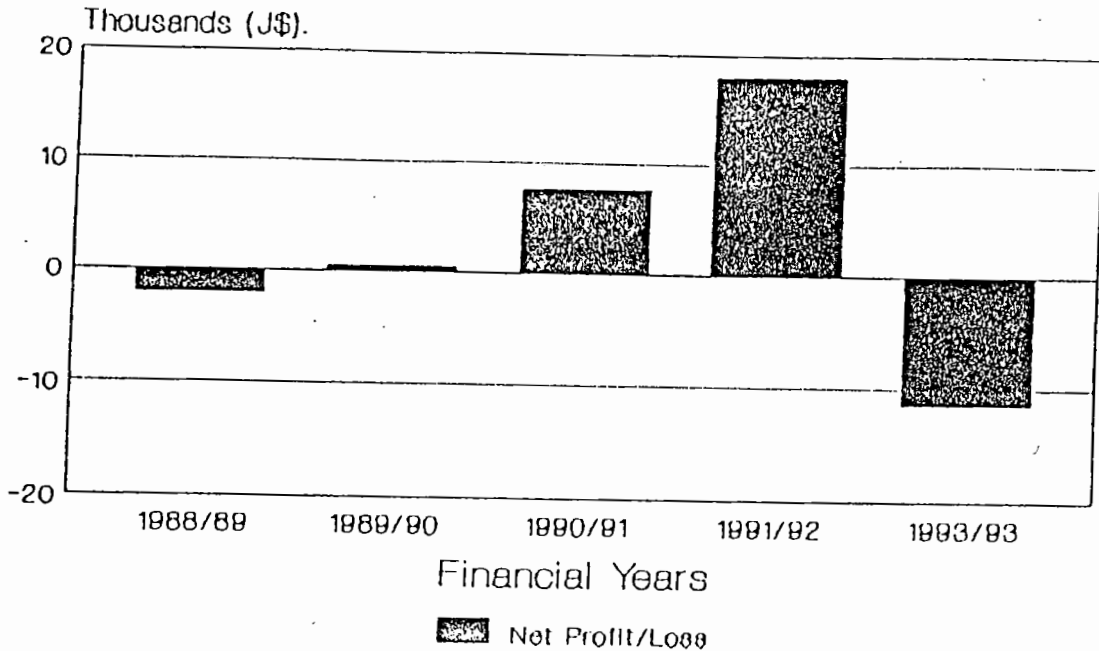
**Fig 3.2 (b) Fish Production*
Aquaculture Jamaica Ltd.
(1989-1993).**



Source: Financial Statements of
Aquaculture Jamaica Ltd.

* Production included from all ponds
owned and managed by Aquaculture Ja.
** Include Production figures up to
Period 49.

**Fig. 3.2 (c) Net Profit and Loss,
Aquaculture Jamaica Ltd.
(1988-1993).**



Source: Financial Statements of
Aquaculture Jamaica Ltd.
Various Years.

The site was completed in 1984 with an initial production acreage of 45 water acres.⁵ For the next two years the company struggled with problems of shrimp production. According to one manager, the production technology was undeveloped and the facility found itself having to research to understand and perfect the technology rather than employing ponds in commercial production.

The project was plagued with disease and water problems. Despite these problems, the management was reluctant to change totally into fish production. Eventually the losses that accrued convinced the Group to move into fish production. Recently, shrimp has been reintroduced, albeit on a small scale.

With the move into fish production, the company moved into an expansive phase. In the middle of 1986, 32 acres of water acres were brought into production. This phase of

⁵ Water acres indicated the ponds involved in production activity. The Total farm size is much larger as it needs to include the roads between the ponds, the office and maintenance area.

expansion was a joint venture with local business man Tony Hart, who owns the ponds of this phase, with Aquaculture serving as the management for the ponds. To overcome the problems of transporting water manually to the ponds, this phase was built very close to the banks of the Black River.

A further phase of expansion occurred in 1989 when a further 28 water acres of ponds were built and brought into production through another joint venture project. One hundred and four (104) water acres are now involved in production. It was at this time that the management of production and financial data from the company began to get burdensome and a computerized solution to this problem was introduced. More will be said of this system in following sections.

The company no longer views increasing its own production facilities as a means of increasing output but is instead relying on the replication of the success of the contract farming experience of the poultry division. Since the programme was launched in March 1991, over 208 water acres have been prepared for production and are able to receive fish. Only 138 have so far been stocked.

On the Brumdec premises, there is also a processing plant which was renovated in 1988 and now has a processing capacity of 250 metric tonnes per month. The plant is able to produce fish in fillet form, sliced or as whole fish.

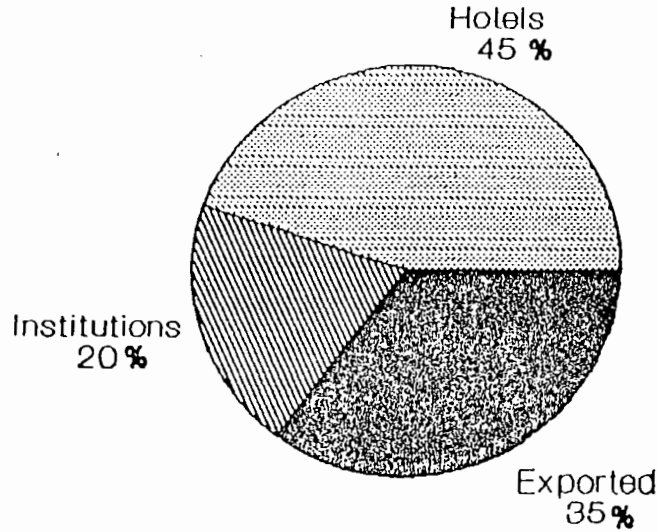
The distribution of the sales indicate that the major customers for the fish are located in the local economy. Fig 3.3.(a) shows that 65% of sales are made locally. This is distributed accordingly: 45% sold to hotels and 20% to institutions such as supermarkets and the Jamaica Defence Force. Exported fish accounts for the remaining 35% of the output. While the information on the distribution of the exported sales could not be obtained, the fish are sent mainly to European and American markets. Fig.3.3(b) show that the local sales remain the more important source of revenue.

The staff complement of operations at Toll Gate and Barton Isle is as follows:

Wages payroll:	85 persons
Salaries payroll:	30 persons
Contract Labour:	45 persons

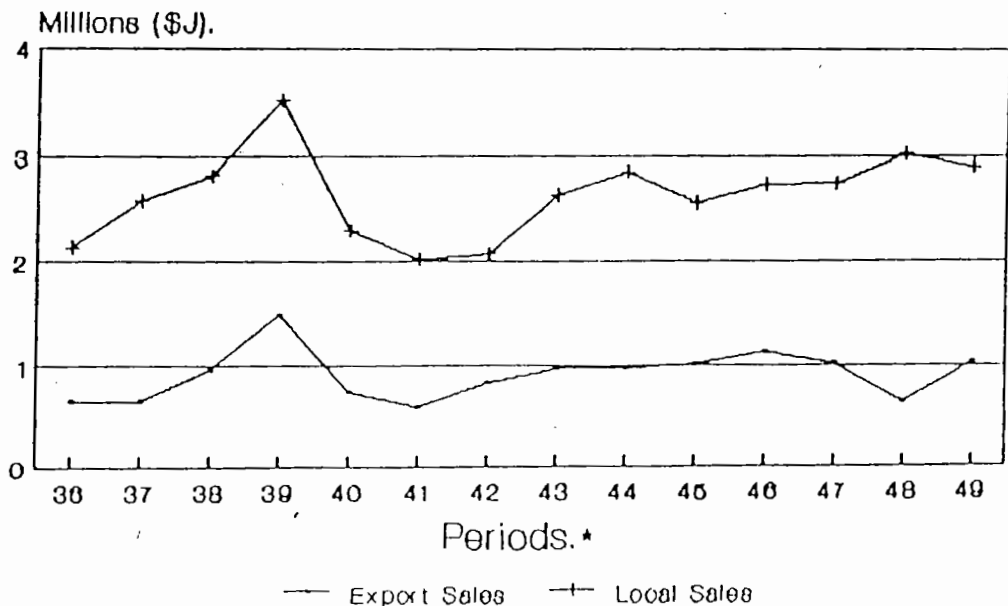
The contract labourers represent security guards, general maintenance workers and temporary workers in the processing plant who are called upon as the need arises. The organizational chart (See Appendix 3) is given.

Fig.3.3.(a) Distribution of Fish Sales, Aquaculture Jamaica Ltd. (1992).



Source: Interview with Mr. J. Carberry, Technical Services Manager, Aquaculture Jamaica Ltd.(14th April, 1993).

Fig. 3.3. (b) Export and Local Sales, Aquaculture Jamaica Ltd, Periods 36-49 (Jan. 1992-Feb. 1993).



*refer to Appendix 1 for Period Dates.

Source: Financial Statements, Aquaculture Jamaica Ltd. Various Years.

The major costs of production is the cost of feed and the fingerling cost or the stocking cost. For period 1 (May 1989) of the financial year 1989-90 to period 49 (Feb 1993), the feed and fingerling cost together constituted 79.4% of the total production cost over the period.⁶ Feed cost accounted for 46.0% of the total production cost for the similar period. (See Fig.3.4). For the present financial year, 1992-93, (up to period 49), feed cost constitutes about 50.0% of the total cost. This has serious cost implications since, while the company obtains all of its feed from Master Blend (the feed blending company within the group), the major portion of the raw material inputs into feed (corn) is imported. Changes in the cost of feed can be expected to have a major impact on the total cost of production for two reasons; one direct and the other indirect. The indirect effect will be through an increase in the feed cost for the fingerlings which would increase the final cost of the fingerling and thus the price of stocking the pond. The direct effect is that the feed fed to the fish will cost more. With these two costs representing 80% of total cost, changes in feed cost have a major impact on the total cost.

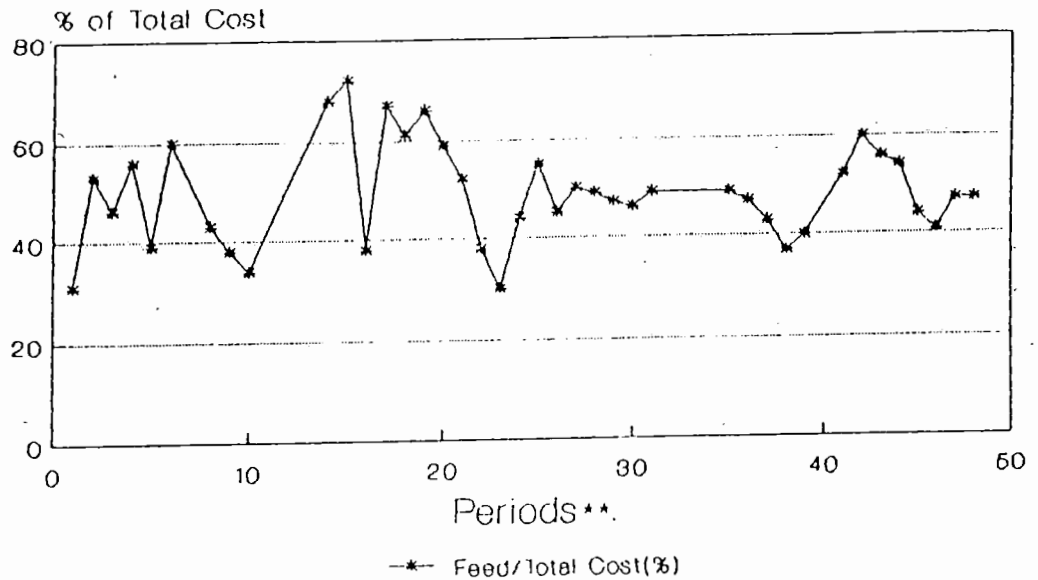
With the continued devaluation in the Jamaican dollar⁷, the cost of feed to the fish increased and there was a large increase in the total cost which is noted when Fig.3.2.(b) is compared with Fig 3.5 which shows that while the output was marginally increasing over the first years, the cost of producing this output was increasing greatly. The increase in the cost of production is reflected in the unit cost increase. This increase can be linked directly to the devaluation of the dollar and the consequent increase in the price of feed.

Aquaculture Jamaica Ltd. is a company attempting to move beyond the traditional exports, attempting to sell what can be termed as non traditional items. The fish fingerlings are exported to Puerto Rico as well as sold in the domestic market. The company has invested heavily in the expanding their production facilities (particularly the processing plant) to support this export effort.

⁶ This was calculated by the researcher based on figures obtained in the financial statements of the company.

⁷ The value of the Jamaican dollar in relation to the United States dollar was J\$18.68 in October 1991, J\$ 22.10 in January 1992, J\$ 27.38 in March 1992, J\$ 22.35 in June 1992 and has since stabilized around J\$ 22.20 for US\$ 1.00.

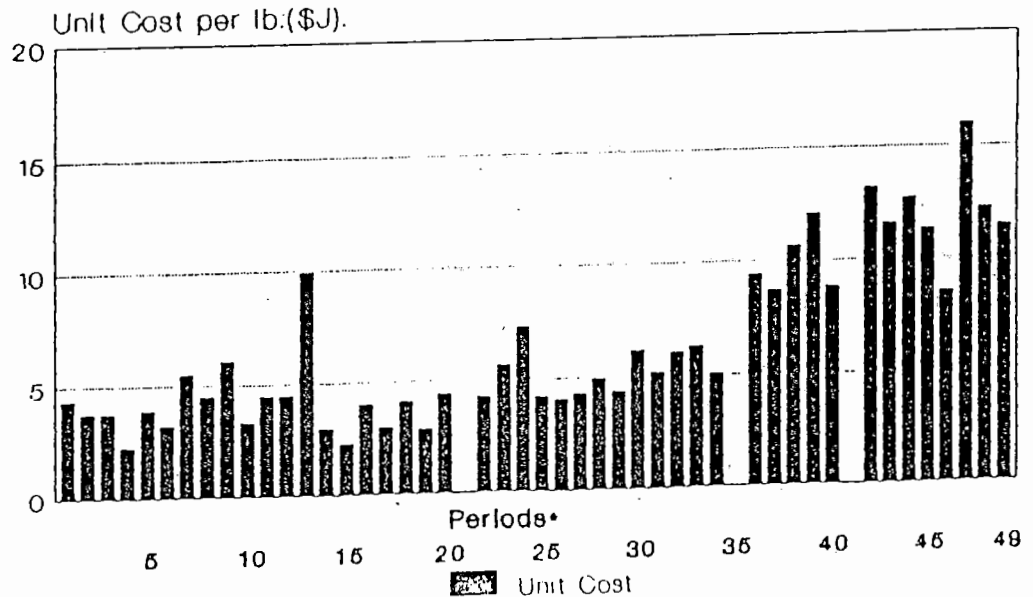
Fig. 3.4. Feed Cost expressed as % of Total Cost, Aquaculture Jamaica Ltd. (Periods 1-48).



Source: Calculated by Author. Cost Figures obtained in Financial State'ts, Aquaculture Jamaica Ltd., Various Years.

* See Appendix 1.

Fig 3.5. Unit Cost (per lb) Over Time, Aquaculture Jamaica Ltd. (Periods 1-49).



Source: Financial Statements, Aquaculture Jamaica Ltd. Various Years.

* See Appendix 1.

Contribution to the local economy also occurs through the provision of a large portion of the fresh fish consumed by the tourist sector. However, the company's contribution, in terms of leading the way in the innovative use of computer technology, should also be considered and will form the basis of this paper.

SECTION 4

METHODOLOGY

The research design used in any study is critical since the validity and reliability of the data collected, and consequently of any findings, will depend upon the instruments used and the manner in which these instruments were used. The current research design was heavily influenced by the fact that the study was to be exploratory; the researcher was involving himself in an as yet insufficiently researched area. Singleton has noted that this type of research is undertaken when relatively little is known about something resulting in a data plan that is more open than other types of research (Singleton, 1988: 90).

4.1 Justification of Case Method

The case study method was used. The method calls for a detailed and critical analysis of one or more cases which exhibit a particular social phenomenon. Hakim has claimed that case studies may be the most flexible of all research designs since it can be used for exploratory research as well as perform rigorous tests on chosen hypotheses (Hakim, 1987: 61). In the execution of the case study, there is also the ability to utilize a range of instruments in order to come to a fuller understanding of the social processes that occur within the organization. The exploratory nature of the research, due to lack of previous research, dictated that the design be as flexible as possible. The case study method was seen as the best way to provide this flexibility. Also given the time constraints for the field work and the small number of users (7) involved, it was felt that only one in-depth study of a particular system could be adequately investigated. For this study, the use of the case study method entailed the examination of the IT activities of one firm.

4.2 Identifying the System and Gaining Access

Once the decision to work with Jamaica Broilers was made, the research period lasted approximately two months, from March 1st. 1993 to April 30th. 1993. The aim was to identify the major IT projects in the various companies in the group and to use these projects for further investigation. Given the constraint of time, however, the decision was taken to use the knowledge of the persons at the Information Systems Department (ISD) to point to the system that was the most developed and operational for an extended period of time. The obvious problem with this approach was that ISD may attempt to steer the researcher to an investigation of projects that put the department in the best possible light. IT projects that may have been very interesting, and which would provide valuable insights, might not have been suggested due to technical or organizational problems. To overcome this limitation, opinions on the issue were had from a number of persons (5) within the organization, including the Co-Managing Director of the group, Mr. R Levy, the staff at ISD, and persons in the organization. In all instances the same system was mentioned. It was by this method that the Pond Management/Accounting System at Aquaculture Jamaica Ltd. was decided upon.

Initial contact with Aquaculture was made through Mr. Levy. ISD then informed the organization about the visit to the site. Due to the remoteness of Aquaculture, it was necessary to live on the farm for the period. The researcher spent two weeks on the farm allowing for intimate observation of farm activities.

The researcher felt, however, that to obtain an idea of the use of IT generally within the company, a visit to the major systems within the group would be useful. The staff at ISD felt that the system at the Master Blend Plant was interesting and so arranged a visit of the facilities. As a form of preparatory work, the researcher asked the systems analyst about the system which assisted in the preparation of relevant questions. This visit was useful in that it allowed the researcher to experience the use of the technology in a company other than Aquaculture, allowing for an identification of some of the problems and issues common to the efforts.

4.3 Research Instruments

During the research, a variety of techniques were employed to solicit information and data. As noted previously, the case study method allows for the use of a variety of instruments to come to an understanding of the issues under investigation. The main instruments used were

elite interviews, informal discussions, official company documents and field observations.

4.3.1 Elite Interviewing

"Elite interviewing" refers to that research technique which attempts to interview persons selected on the basis of their presumed access to, or possession of, specialized information relevant to a research question (Manheim & Rich, 1986: 132). Using an unstructured interview approach, the researcher provides only guiding questions that probe the respondent to provide information on the particular subject under study. This approach allows the researcher the flexibility to delve into new information that may come to light during the interview. Manheim and Rich claimed that the unstructured approach provides the "opportunity to learn from respondents and acquire unexpected information that can lead to truly new ways of understanding the events being studied." (Manhiem & Rich, 1986: 133).

This research relied primarily on this approach in the choice of persons to be interviewed since, with the system being so small and with so few users, each person was able to provide specialized information. Also each users interacted with the system differently, making the administration of structured questionnaires difficult.

At Aquaculture Jamaica Ltd., all the persons who had been involved in the initial stages of the project, and who were still at the site were interviewed (See Appendix 4). Also, all seven users of the system were interviewed. Actually living on the farm allowed the researcher easy access to users and ensured that the data gathering took less time than in a situation where the researcher only visits the premises for an interview. In the case of the staff at ISD, the numbers of persons who could provide information was so small (3) that it was possible for the researcher to interview all of them, sometimes on more than one occasion. At ISD, the appointments were made over the telephone and the researcher visited at any time. The Group Managing Director, was interviewed twice due to his direct involvement in the effort to use information technology. On a visit to the animal feed production plant in Clarendon, two users of the system were both interviewed.

The interviews usually began with the researcher stating his purpose and stressing that the project was part of an independent study being conducted for academic reasons. This was done to reassure persons that the information provided will not be used by, or on behalf of, senior management, thereby circumventing some of the

reluctance that persons may have. Respondents were then asked to give information on their utilization of the Pond Management system. Interruptions were made for clarification and for elaboration of issues that may have come up in interviews with other persons. Every attempt was made to ensure that persons were interviewed close to a computer terminal so that their interaction with the programme could be demonstrated as well as explained.

The interviews were taped. This facilitated eye contact during the interviews, permitting the development of a rapport between interviewer and respondent. Prior to the interview, permission was sought for the use of the micro cassette recorder. On only one occasion was there a refusal to be taped. Every effort was made to make the respondent feel at ease. This meant diverting at times to subjects as West Indies cricket and issues in Trinidad and Tobago politics. The information transfer that occurs in the interviewing process is facilitated by the use of tact and skill (and luck) to put the respondent at ease and build his/her confidence in the interviewer.

4.3.2 Official Sources (Documents)

A variety of official sources was consulted and made readily available. The group's annual report, as well as the prospectus prepared when the company went public in 1992, were perused to obtain information about the group's performance over a period of time and historical information about the company. Aquaculture also allowed perusal of financial information and statements.

4.3.3 Informal Conversational Interviews

This method can be viewed as the researcher's attempt to remove oneself from the strictures of the role of the researcher so as to allow persons to become more at ease, and hence more cooperative and responsive. Patton has referred to this as the "informal conversational interview" which relies on the "spontaneous generation of questions in the natural flow of an interaction." (Patton, 1990: 280). This meant that the researcher may ask questions that might not have a direct bearing on the topic but which allowed the subject to develop some rapport with the researcher and facilitated further interviews which may then focus on the issue at hand. The method proved to be particularly useful when the researcher had to spend some period of time in the research setting (Patton, 1990: 281). During lunch or while waiting to be driven home, valuable information on some of the more informal aspects of the utilization may be released. For example, while having lunch, one of the users described, in a laughing manner, how himself and one other user attempted to fix a problem that had once

occurred with the system which was important to the researcher but provided in an informal setting rather than in the formal interview situation.

4.3.4 Field Observations

The researcher was required to be constantly aware and observant of other activities and conversations occurring around even while more formal instruments were being used. Observation of certain behavioral actions was used to confirm evidence given in an interview. For example, in the case of the senior manager who claimed that he was an avid user of IT, unknowingly provided proof of such, when the extent and the ease with which that person used the technology is observed.

4.4 Method of Data Analysis

The information collected using qualitative methods such as interviewing can be more difficult to analyze than those collected using quantitative methods. Much of the information was recorded using tapes or written notes. The researcher attempted to review the interviews in order to establish the factors that appeared to contribute to the utilization of the Information Technology effort. The field notes were also reviewed using a similar criteria. The observations that were made while interviewing, which were sometimes recorded in notes or in memory, were also used in attempting to decipher the data collected.

4.5 The Politics of Research

During the research process, issues emerged which, while not specifically concerned with the validity and reliability of the information collected, can affect the ability of the researcher to perform the research and produce the final research output. These may be termed the "politics of research" and include some of the more subtle, but potentially damaging, issues that can be encountered in dealing with the people and groups who are the subjects of the research. These issues are discussed below in two parts a) Researching Organizations and b) Ethical considerations.

4.5.1 Researching Organizations

The researcher who undertakes the research of an organization has to be part researcher, part administrator and full-time diplomat (Chadwick, 1984: 287). The research process becomes one of continuous negotiation with various persons over issues such as the research questions and access to certain forms of information. Some events that occurred in this research, and discussed below, illustrated

that sensitivity to the politics of the firm is critical to the success of research done on a firm.

The initial rejection of the proposal to study in Trinidad and Tobago illustrated that the researcher may have an easier access to the firm if initial permission is obtained directly from senior management. With one of the firms in Trinidad and Tobago, entry was made via a middle manager who had little authority to approve the study. This caused delay in gaining permission and prevented the researcher's interface with the permission granting authority. The negotiation of the research agenda was therefore completely outside of the researcher's control. At Jamaica Broilers, once permission was obtained from senior management, it was relatively easy to perform the rest of the fieldwork.

Also the passage of the researcher would be aided if the researcher considered the research process, not as a one way extract of information, but rather an opportunity to share skills with the organization. In this case, the offer was made to assist in the introduction of a hand held computer unit for the salesmen of Best Dressed Chicken. The offer was accepted and so the researcher will be able to contribute in a tangible way to the organization. This, it was felt, helped in developing confidence and openness with the researcher.

4.5.2 Ethical Considerations

The social science researcher needs also to be conscious of the trust placed in him by the persons and the firm to be investigated and to adhere to ethical practices in the research (Burgess, 1984: 207). This trust was especially critical for the financial information made available to the researcher. Certain facts such as unit cost and total cost, while not major secrets, can be potent weapons in the hands of competitors. Strict confidentiality in financial matters is therefore important. In fact, one company in Trinidad, claimed that the study could not be permitted since financial information may be revealed to competitors.

Confidentiality of informants was also considered important. Given the small number of persons who were involved in the research, there was the difficulty of respondents remaining anonymous. While none of the respondents asked for his/her name to be withheld, the researcher attempted, as best as he could, not to identify persons who gave particular information.

The host organization's control over the final product of the research is another important issue. Academic

freedom suggests that organizational veto over the final version of the research paper, is unwise (Whyte, 1984: 219). However, Jamaica Broilers suggested that a draft of the research findings be reviewed by the organization before final presentation. The solution to the problem was for negotiation at the time of the presentation of the draft so that the final effort is acceptable to both parties.

SECTION 5

DATA ANALYSIS

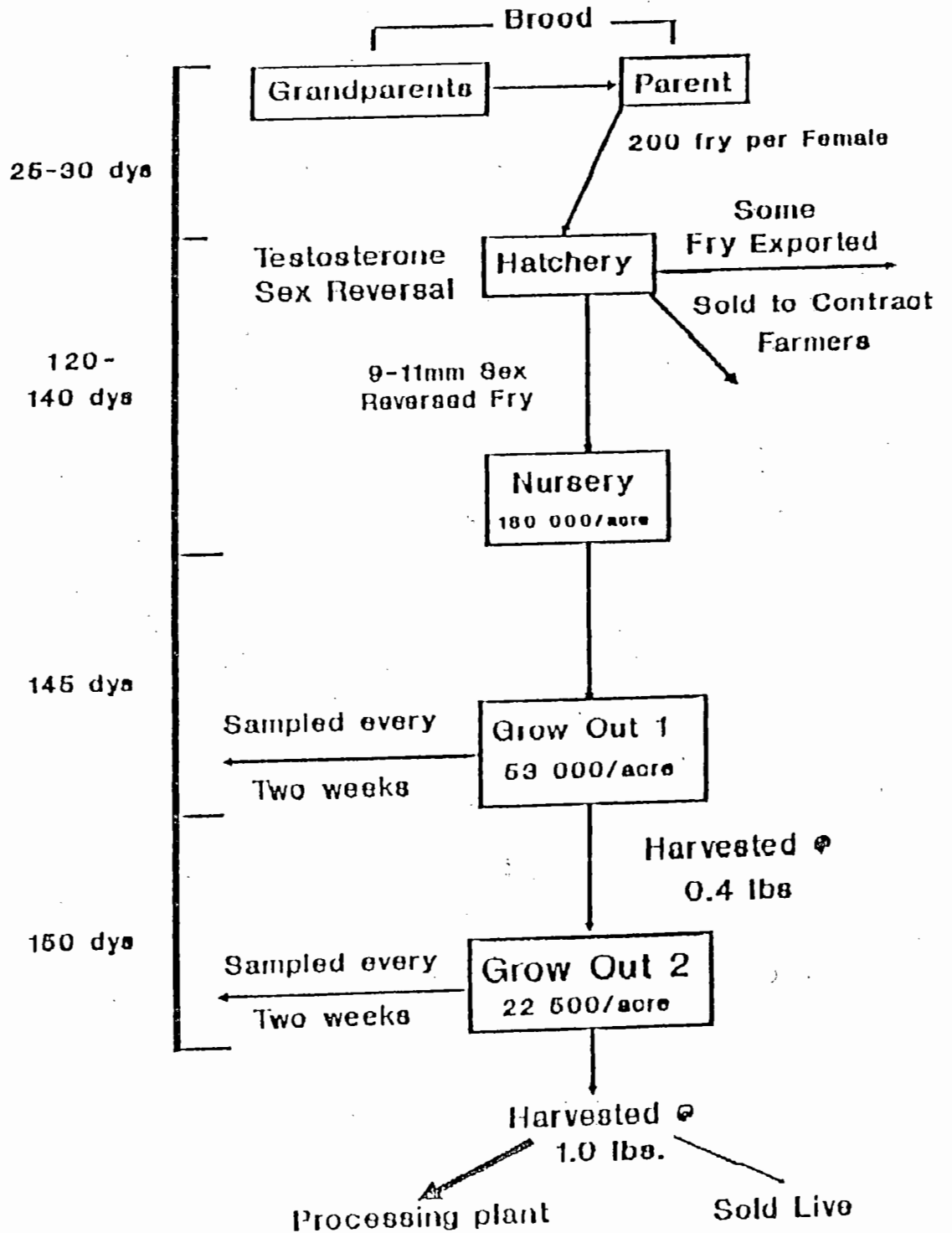
5.1 The Process of Fish Farming

The production of fish begins at the brood ponds. In this phase, mature fish are stocked at a ratio of 3 female fish to one male fish. There are two types of brood ponds: a) the "parent" stock which is used to produce the fry; and b) the "grandparents", used solely to produce the parent stock (See Fig 5.1). Each parent female produces about 200 fry per month and the harvest for fry begins about 14 days after the brood is brought together. This harvesting continues until the parent brood has been together for about 25-30 days.

These fry are taken to the hatchery and stocked in tanks or ponds with continuous water exchange and aeration. They are fed a finely ground feed at regular intervals containing a synthetic male hormone, which, when given to the 3-7 day old fry, effectively turn the female fish into males. This ensures that growth rather than reproduction occurs in the later stages. When the fry reach about 9-11mm. in length, they are moved to the nursery pond and stocked at a density of 180 000 per acre. The nursery process lasts for 120-140 days with survival averaging 60%.

The fish are then sent to the large ponds for the grow out phase; the phase during which the fish gain most of its final mass. It should be noted that each set of fish in a pond is referred to as a batch and is given a batch number which gives information on the type of crop, where the initial stock came from and the pond in which the batch is located. Grow-out is a two phase operation. In the first phase, the fingerlings from the nursery are stocked at 53 000 per acre and are grown for 145 days. Harvesting occurs when the fish reaches an average size of 0.4 lbs. In the second part of the grow out, the fish are stocked at 22 500 per acre. Sampling occurs every two

Fig. 5.1 A Diagrammatic Representation of Fish Production



weeks so as to establish the average weight of the fish in the pond. They are grown for 150 days, after which the fish will be expected to have attained a size of one pound. Harvesting of the fish occurs using seine nets and feed which encourages the fish into the net. Once harvested, the fish are transported live to the processing plant and are kept alive until processing. In the processing plant, the fish are kept in cold water, which slows their metabolic rate, until carried into the processing room. The fish may be filleted, gutted or sold whole. A small amount of the fish is sold live.

In the grow out phase, the feeding of the fish is done by tractor that pulls a container of pellet form feed. A moving tractor blows the feed into the ponds. Feeding is done approximately 3 times a day.

One critical factor that affects the growing of the fish is the level of oxygen in the water. Oxygen levels are dependant on high wind levels, the amount of sunlight and the degree of water "flow through" that occurs in the ponds can be increased mechanically using aerators, air diffusors or a flow through technique. Low levels of oxygen cause the fish to be inactive and stressed, reducing their metabolic activity and consequently their desire to feed. The result is uneaten feed which represents a waste of feed (the largest component of fish production cost) and leads to slower fish growth. High levels of oxygen are not a problem.

5.2 The Pond Management\Accounting System

The data that is needed to manage and control production on the farm is stored and manipulated in a system that is termed the *Pond Management System*. The demand to computerize the management of the Ponds came from the expansion of the farm. With an initial number of 26 ponds, the paper work was large. It took one accountant the entire period to ensure that the costing figures were ready and prepared for the end of every four week period. Robert Levy, the Managing Director of Aquaculture decided that a computerized system should be set up to take over the management of the information that is necessary for fish production.

The programme is written on a Dataflex platform. It uses a number of data files, each of which serve separate purposes. For example, one file is dedicated to financial transactions, another to the physical movement and sampling of the fish and another to summary history of the ponds. Through entry screens, the programme accepts information (production or financial) storing it in the relevant file.

The system is arranged as a local area network (LAN) based on a client - server mode. The network software is Novell 286, Version 2.12. The File Server has a 386 Central Processing Unit and a disk capacity of 660 Megabytes. The File Server acts as a central data store and contains the Pond Management software as well as the other "off the self" packages that are used by various members of staff. All the personal computers (PC's) are connected to this File Server. The PC's included in the LAN can be termed workstations. Through these workstations, the users are able to access data and software contained in the File Server. While the Novell network software can permit simultaneous access for up to 50 users, at Aquaculture only 7 workstations are served. Appendix 5 lists Aquaculture's computer.

The programme is able to provide the users with a range of production information, some provided in a structured form. One such structured output is a pond card (See Appendix 6). The pond card indicates the status of the particular pond at a particular time and provides information on the batch that is presently stocked, the purpose and the length of time which the particular batch is expected to be kept in the pond. Additionally, information is provided on the stocking of the pond: how much was stocked, its weight and the source of the stock (ie. the batch from which the stock came). The card also has provisions for the production of harvest data. In completed Pond cards, the dates that the pond was harvested, the mass harvested, the age at which the pond was harvested and the destination of the harvest are all included. These completed ponds also have feed fed, estimated survival and the *Feed Conversion Ratio*⁸, the sample data on the pond as well as the daily readings of dissolved oxygen and temperature. Similar information can be obtained by accessing the batch menu.

The programme provides information on the status of the ponds presently in production. This output provides information on the size of the pond under production, the date stocked and the density, the average weight stocked and the present average weight as well as information on survival and days to harvest. Therefore, at a glance, the manager is able to have concise information on the state of the ponds at any one time. Previously, this pond status could only be achieved by going through each pond card, capturing the appropriate figure and entering it on a pond status card. This process was tedious and time consuming.

⁸ The Feed Conversion Ratio (FCR) is a measure of the efficiency of the fish in converting food into flesh (body weight) and is calculated as *Food Fed/Weight Gain*.

At present, the status of the ponds can be obtained quickly and in an up-to-date manner. Status cards for each phase of production (the hatchery, the nursery and grow out phases) are available.

The programme also permits the tracking of fish over time. As noted previously, as the fish grow they are moved from various sites. It is important to locate the movement of a particular batch over time. This type of information is useful in trying to explain some aspect of fish performance. For example, on one occasion it was realized that a number of batches had not performed efficiently and their harvest weight was very low. Using the system it was seen that all these batches had been hatched from a brood which had been imported, and not from Aquaculture's brood stock. In order to provide information on the movement of the fish, all the transfers of fish that occur must be entered at the appropriate menus. The fish movement output provides information on the ponds the batch had previously grown and the length of time spent in each pond.

Additional menus are provided for the users to enter and review information. There is also an option in which all the feed information is input and reviewed. From this, the daily feed schedule is generated.

To facilitate investigation and analysis, the programme has a "Query" function. This menu provides the user with a number of parameters (about 150) that are related to fish production. These include feed conversion ratio, stocking density, dissolved oxygen, weight harvested, etc. The user is able to investigate performance by defining certain characteristics that may be important to the user and requesting an output on the ponds or harvests or batches that may satisfy these parameters. The ponds satisfying the given definition can then be examined to provide information on similar characteristics of the ponds. For example, the user can select all the ponds having a recovery greater than the average recovery, and can then review characteristics of all these ponds. The user can search to establish if increased recovery is related to high stocking densities or fish from a particular brood. Users said this function is extremely useful in aiding decision making.

On the accounting end, the programme is called the *Pond Accounting*. The system is very similar to the production programme with the main difference being that all of the information included in this programme is given a cost. Therefore, feed information is provided in terms of its cost and not in weight units. Each pond is treated almost as a cost centre; each pond would accumulate cost. First there is a stocking cost. The computer links a

stocking cost to the pond or batch. It also tracks the amount of feed fed to the pond for the entire lifetime of the batch. The various other direct costs such as labour, repairs to equipment and other costs are apportioned equally amongst the ponds. The programme is able to provide a total cost for each batch from which unit cost, feed cost and other financial variables can be calculated.

5.3 Benefits From the Utilization of the Pond Management/Accounting System

The benefits that have accrued due to the use of the system are difficult to quantify. With the systems being used primarily for decision making and data management, the actual contribution to efficiency gains (or reductions) to production is difficult to measure. Improvements in decisions to feed the fish or harvest the fish may be overshadowed by movements in feed price. Measures such as unit cost would not capture such a gain. The feed conversion ratio, which depends on a range of factors, would be a crude indicator of efficiency gained by the use of IT in the decision making process. Even the impact that the introduction of IT will have on profits is difficult to measure. In a situation where the technology is used, not for greater product differentiation or development of new products, but rather as a decision making support system, then the direct impact on profits can only be hinted at, never fully measurable. This is not peculiar to the effort at Aquaculture since, as noted previously, this is a feature of IT efforts generally.

However, while quantifiable benefits cannot be easily ascertained, users thought that the system is indispensable. As one user stated "it (the Pond Management System) has aided me immensely; without it I can't imagine how I would do my job." Given this, the users' perceptions on the advantages of the system can be used in accessing the benefits.

One benefit that was constantly mentioned was the amount of time saved by using the system. One user noted that previously, most of his day was consumed with entering data into the pond cards and attempting to keep these cards up to date. This left him with very little time to actually survey and examine conditions on the farm. This was occurring when the farm was almost one third the size of the present facility. With the Pond Management system, the pond cards are automatically updated with each day's entry. Time saving also is achieved by the system's ability to allow for various users to browse through for information easily. Therefore, when the general manager needs some production information, no longer is it required to call on the particular person since he is able to access

the Pond Management programme, through which one is able to obtain up-to-date production or accounting information. This, therefore, saves time and permits quicker access to necessary data.

Another direct benefit comes from the time taken to prepare the daily feed schedule. Before the system was installed, the daily oxygen and temperature levels had to be entered in each pond card. Following this, certain calculations must be made in order to establish the amount of feed that needs to be fed for that day given the entered parameters. The feeding of the fish could not occur without this daily calculation being done. The user responsible for this function recalled that it would take about two hours of constant work to produce this feed schedule for nine o'clock in the morning. This was a difficult deadline to meet even when the farm was only 26 ponds. At present, the Pond system ensures that the production of the daily feed schedule is easier since the programme generates feed information once the temperature and oxygen figures have been included. The user has the ability to change the feed requirements as he sees fit but a feed schedule is generated within seconds of entering the data. Feeding of fish now occurs regularly at about half past eight in the mornings.

The system also permits the users to scan for trends in the data. Using the manual system of Pond cards, the physical process that would occur just to collate the data for one variable involved a great deal of time; analyzing the data in such a form was difficult and tedious. Two of the users felt that certain types of the information that they presently receive could not even be calculated by hand. Maintenance of physical pond cards did not allow for quick information retrieval and analysis and the data could be not easily manipulated to teach the managers and the users. The present system has a "Query" facility which gives the users the ability to manipulate data to satisfy their own particular inquiries with quick results.

The system is also able to provide greater control and protection of the production information. Controls are in place that discriminates the access different users have to the system. The managing director is able to afford some users 'read only' access to some information ensuring that such users cannot make changes to the data. Accessibility to information is controlled and regulated.

Another advantage mentioned of the system was the accuracy of the information provided. When the feed and other financial calculations had to be performed manually, the potential for error was greater. Also the process took a considerable period of time to complete. At present, the

relevant formulae have been included in the programme and are automatically calculated with the input of the relevant information. The managers all indicated that they receive calculations much quicker and have much more confidence in the figures so calculated.

The storage of data is easier. Previously there were numerous books and leaflets representing pond cards, completed and in use, others in which the daily oxygen and temperature levels were recorded and yet more to track the movement of fish over time. With this many books, the process was prone to become chaotic. There would be problems if books were lost since back up information was not easy to maintain. With the new system, physical storage of the information is much easier and tapes of data are kept in separate locations ensuring that adequate back-up is maintained.

Another benefit is the rapidity and the variety of reports which can be prepared. The Period report that is produced is extensive and the manual preparation would be tedious. The system, however, has the same format of the General Ledger and this makes the preparation and production of financial statements much easier.

All the users agreed that the system is extremely useful and makes their job easier. They appeared, from observation, to have very little problems with using the computer and were all quick to refer to the monitor so as to illustrate or elaborate a point. None of the persons interviewed felt that the system was an impediment. Rather, the Pond Management System is seen as critical to the management of production operations at Aquaculture. Given this, one can conclude that the Pond Management System is being extensively utilized. The gains, while difficult to quantify, were clear to the users.

The following sub section, therefore, attempts to indicate some of the critical factors have impacted on the utilization effort. It should be noted from the onset that, despite the users satisfaction of the system, there are factors present, that may not be obvious to the users, that can be expected to adversely affect the continued utilization of IT at Aquaculture.

5.4 Impact Factors

Utilization of Information Technology is dependant upon a number of factors which may be termed inhibitors or facilitators. *Facilitators* are those factors which appear to have aided in the efficient application of the new technology and systems: in its development, deployment and continued utilization. The *inhibitors* are those factors

which have, or can be expected to, constrain the development, deployment or continued utilization of IT in the organization. Table 5.1 below gives the main factors that appear to have impacted on the IT effort.

These impact factors are not confined to organizational factors but include those factors from the external environment expected to affect IT application. This section of the analysis, therefore, concentrates on the identification of the inhibitors and facilitators of the drive to utilize the technology at Aquaculture. Each of these factors will be elaborated in order to expose the manner in which they influenced, or can be expected to influence, IT utilization. Two points should be noted. Firstly, these factors, while being the most significant to the effort, are not the only factors that have contributed to utilization. Others have also aided or hindered but the aim was to discuss the critical factors. Additionally, many of these factors are also closely inter-related, making it difficult to precisely demarcate each factor.

TABLE 5.1

**IMPACT FACTORS ON THE INFORMATION TECHNOLOGY
EFFORT AT AQUACULTURE JAMAICA LTD.**

	Facilitators	Inhibitors
1	Top Management Commitment and Support	Locational and Infrastructure Deficiencies
2	Strong Technical Support	Lack of Documentation of the IT Effort and Systems
3	Sense of Ownership and Mastery by Users	Lack of Formalization of the IT strategy.
-	-----	-----
4	Strong Financial Commitment to IT	
-	-----	
5	Culture of Innovativeness	

5.4.1 Facilitators

5.4.1.1 Top Management Commitment and Support

This section will deal with the role of the present Managing Director⁹ in promoting the utilization of IT and the support of the top managers at Aquaculture to the IT effort. Top management support was championed at two levels. At the senior management level, the Co-Managing Director was a supporter of IT cause while firm level support came from the managers of the company.

Mr. Robert Levy was the initiator of the use of IT in the group. According to Mr. Levy, the impetus to use computers came as a result of the group's growth, which placed increasing demands on group accounting personnel. Financial accounts became increasingly difficult to compute and consolidate manually. An employee in the accounts department, acquainted with some accounting spreadsheets available at the time, suggested that computer technology may be one way to solve the problem. Mr. Levy agreed to experiment with the technology and purchased an accounting software package called "Visicalc". He then retired to "the hills of Newcastle" for a few weeks where he learnt all he could about the software package. He recognized the enormous potential then that the technology could have, not only for the accounting procedure, but for activities throughout the Group.

Levy also linked the technology with a biblical event; the building of the tower of Babel in which men attempted to use skill and guile to build a tower up to heaven.¹⁰ The part of the story which struck Levy was that nothing would be impossible for man. He saw IT as one effort which can help push man to perform feats previously thought impossible, capable of making tremendous change to mankind.

Since then, and as a result of this experience, his IT goal for the group has been guided by the philosophy that all data should be captured electronically at the point of

⁹ Robert Levy was Co Managing Director during the process of application of the effort. As of April 1993, he is the Managing Director of the Jamaica Broilers Group Ltd.

¹⁰ This story is located in the Book of Genesis of the Bible.

creation.¹¹

As the Managing Director of Aquaculture and the person who actively supported IT development in the company, he attempted to ensure that persons were aware (and constantly reminded) of the full utilization of the technology. Four users mentioned that Levy admonished them for using paper rather than the computer. One user mentioned that Levy said he no longer wished to see any pens around, and another, that Levy no longer wanted to see his "library" (in reference to the many books that were kept when production data was stored manually).

Additionally, Levy not only supports the technology in theory, he is also a major user of the technology. During interviews he was easily able to interface with the computers in his office and appeared comfortable with general hardware, software and peripherals. The researcher witnessed an exchange between Levy and the ISD manager, in which the technical familiarity of Levy with the technology was displayed. He was also fully cognizant of the Pond Management system and its uses.

Mr. Levy has ensured that organizational commitment was maintained at the most senior level. Through his actions, users at Aquaculture and its top managers felt that senior management was committed financially, personally involved and interested in the IT process. This role is similar to the dynamic and proactive behaviour shown by Swire and Bartley in their approach to the acquisition and application of new technology in Elarc, Jamaica (Girvan and Marcelle, 1990: 103-4).

Levy has acted in this case as the technological champion: the individual who by status and personal involvement ensures 1) that the technology gets used in an organization and 2) that once implemented, the users are motivated to utilize the technology. The role played by Levy confirms the evidence and analysis presented by Jarvenpaa and Ives that executive involvement was strongly associated with a firm's progressive use of IT (Jarvenpaa & Ives, 1991: 216). Levy was seen as the chief facilitator and proponent of the IT effort at Aquaculture.

The top managers at Aquaculture have also been involved actively in the technology. Support at this level occurred for two reasons. Firstly top management was

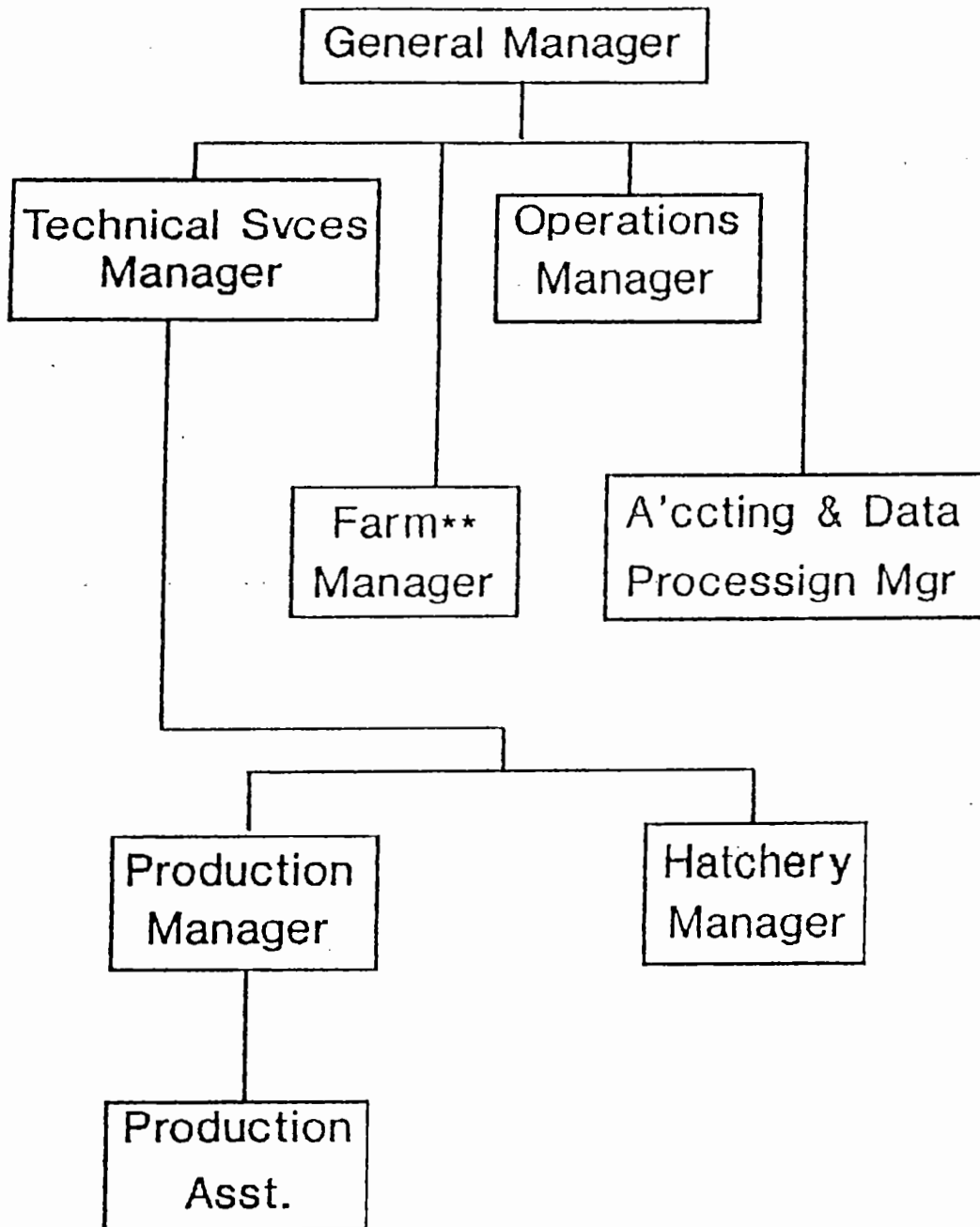
¹¹ Much of the information on Mr Levy's personal involvement in the early IT effort was contained in an untitled speech he gave to The Jamaica Institute of Management on Saturday, May 8th., 1993.

personally very interested in computers: they had some technical understanding of computer hardware and software and secondly, the users were in the main, the top managers. See Fig 5.2 for an chart representation of the organizational status of the users. The General Manager and the Operations manager were both knowledgeable in the use of the system and also the technical aspects of the technology. The impression formed by the researcher following interviews with both these persons was that they were deeply committed to the advantages of using the technology. They were willing to involve themselves as much as possible in all aspects of systems development and maintenance. One top manager even admitted to performing actual (albeit on a small scale) maintenance of hardware. Two of the managers had used the technology prior to joining the company, which assisted in their ability to use the system. Aquaculture's senior management was comfortable with the technology, convinced of the benefits the technology could bring and ready to use the system.

The technical competence of the top managers of Aquaculture assisted in the articulation of their needs to the technical staff. Management was able to convey, sometimes through the technical language and lingo used by computer specialist, the type of system they were interested in and gave detailed description of what was needed. This not only assisted the technical staff in being able to understand the needs but also ensured that the system developed was relevant to the needs of the users. The ability of the users to clearly identify and articulate their IT needs allowed the development of appropriate software.

The commitment and support of Aquaculture's management was strengthened by the fact that of the seven major users of the systems at Aquaculture, three were top management. This ensured that the managers had a first hand knowledge of the benefits of the system thereby creating support for the system. Top management support was therefore forthcoming for the IT effort, through the commitment of Mr, Levy and the interest and support of the managers at Aquaculture.

Fig 5.2. Organisational Chart Showing The Organisational Status of Users.



** Position Vacant

5.4.1.2 Strong Technical Support

The Information System Department (ISD) is responsible for the Information technology needs of the entire group: for the sourcing, implementation, installation and follow up of all the group IT needs. By the classification given by Hodgkinson (1992), the IT structure can be termed "centralized". The Department is a division of Levy Industries Ltd. which is a subsidiary company (See Appendix 2) and consists of two sections: the hardware personnel and the software personnel. On the hardware side there are two persons; a technical assistant and a systems engineer. On the software side, there are also two persons; a programme analyst and Systems analyst. At present, but temporarily, there is also a consultant on staff with the responsibility for providing documentation for all systems in the group. The manager of the Department assists both hardware and software sections.

The Department was established in the early 1980's¹² to provide IT services to the entire group of companies. Users are able to access the technical services, both for hardware and software, in order to have systems developed, modified or maintained.

Requests for systems usually are initiated by the users. Most of these requests are in response to group directives which may suggest that there should be the standardization and compatibility of certain group functions and operations. The user will send a request to ISD where it is allocated to one of the persons within the department. This person is then responsible for researching the specifications and for meeting with the users in order to establish the exact needs of the users. The service that ISD provides is sold to the users. Previous to the 1992-93 financial year the service was subsidized. At present, the department has been required to operate as a profit centre and so is more meticulous with costing of services.¹³

The strong technical support is gauged by two points. Firstly, the staff at ISD have attempted to provide the users with the best services possible. This has been translated into an emphasis and reliance on their own

¹² This was the best estimation of a date that could be obtained after questioning both Mr. Levy and the staff at ISD.

¹³ At present the cost of a visit by one of the ISD staff is J\$700 an hour. Travelling costs are calculated separately.

technical skills to provide equipment and systems that are very efficient and best suited to the needs of the user. Secondly, the manner in which the department approaches systems design and development is one that encourages user participation and involvement.

In an attempt to control the quality of the hardware supplied to users, the department insists that it assembles its own computers, using a variety of parts from different manufactures. One hardware personnel regularly surveys the various computer magazines in order to establish parts that could be used based on quality, efficiency and cost. The various parts are then ordered through the foreign subsidiary of Jamaica Broilers and shipped to Jamaica. Once in Jamaica, the various parts are used to build computer units. The end product is therefore, not a unit of one brand, but a composite unit made up of parts from a variety of suppliers. This produces cheaper units, according to the department, that have better performance to many 'off the shelf' packages.

On the software side, the technical staff have decided to custom build all of the systems to ensure the provision of relevant programmes. The Pond Management System, the Group Stores system and the Flock Accounting System which manages the chicken flock at Best Dressed Chicken were all developed by the personnel of ISD. This method of systems development, is in fact a response to the nature of the applications for which systems are required. Fish and poultry production have peculiarities that make the use of "off the shelf" applications difficult. Even if a software package is located which can be used, it is felt by the software technicians that major modifications will be required to accommodate the specific needs of Aquaculture. Given this, there was the decision to custom build all applications. This, along with the fact that there was heavy user participation in the development of the systems, ensured that from the onset, the system was relevant to the needs of the users, which provided an impetus for utilization.

The manner in which the technical personnel approach systems design, development and modification is based upon user participation and involvement. At Aquaculture, once the decision was made to use an Information system, the system developer from ISD met with the main user and planned the functions that the programme should be expected to perform. Because the programme was to be custom built, heavy user participation in the development stage was essential as fish production has its peculiar information demands which can only be provided by the users. Once the system was developed, the programmer went through the system with the user, ensuring that the system was

understood, and accepted recommendations as to how the system may be altered. Only after this was the system fully installed and the Pond Management System used. The participative approach ensured that the users felt the system was relevant to their needs, thereby promoting utilization. It also established in the minds of the users the importance of their input in systems development. User involvement promoted the feeling that they were able to contribute, establishing a system development process of consultation rather than technical dictation.

The ISD service was initially available to users in the group at very little cost, providing another impetus for use of the technology. The group management attempted to diffuse the technology throughout the group, using a system that consolidated the scarce (and expensive) human and physical resources in one area, from which they could service the needs of the group. This was very useful, since in the case of Aquaculture no mention was made of the cost that was incurred in setting up the system. The impression given by the senior managers of Aquaculture was that this factor was not critical since group management was behind the effort. Even so, the cost of the effort was lessened with the location of technical services in ISD. While there had to be initial outlay of capital to purchase the hardware, the rest of the support services were delivered virtually cost free. The recurrent cost to maintain hardware and develop the software were quite small because of the provision of subsidized IS service. Such a service facilitated sensitization of the users to IT by reducing the recurrent outlay assigned to the effort thereby encouraging use of the technology.

Given the above points, it may be concluded the quality of technical support for the IT effort at Aquaculture was strong and provided in such a manner that it encouraged adoption and user utilization.

5.4.1.3 User ownership and mastery

User ownership and mastery refers to the extent to which the users are confident in operating the system, are conversant with the functions and operations included in the system and generally feel comfortable with the system. The indicators that suggest the existence of ownership and mastery are **a)** that systems development is user driven and **b)** the extent to which users feel sufficiently capable to remedy problems that occur in the day to day operation of the programme.

This sense of ownership was displayed in the fact that every user had ideas about how the system should be developed. By operating the system continuously, the users

had realized some of the present limitations of the system and were willing to give ideas about where the system could be improved. Demands are made on the technical staff to provide improvements to the system.

Two examples may be instructive. One user indicated that at present the Pond Accounting and the Pond Management system were not linked. Therefore information relevant to the accounts department had to be taken manually from Pond Accounting put onto sub journals and then sent to Accounts where it is entered in the general ledger. This user felt, however, that it was reasonable to expect the information entered from the Pond Management to be automatically entered in the Pond Accounting system and posted in the general ledger. In order to facilitate this, an audit of the Pond Management system was requested from Price Waterhouse to ensure the system adhered to accounting procedures and practices. The company is presently awaiting results of the audit and once the system is accepted, the systems can be linked.

Another example of the ideas which users have for the system came from the Production Assistant. His duties include entering the temperature and oxygen levels every morning and then generating the feed chart for the appropriate ponds. The system however does not, in suggesting the amount of feed that should be fed, take cognisance of the present temperature or oxygen readings. Instead, the feed that was given the previous day is suggested as the feed that should be given today. Much still depends on the persons entering the data to alter the suggested feed accordingly, given the daily weather conditions and production activity that is planned for that day. This, the production assistant felt, was an area where the system could be improved; the programme should be able to recommend a feed amount that reflects the temperature and oxygen levels. The user has recommended the change to ISD "a few months ago".

Both these examples illustrate that the users of the system have ideas about how the system should be developed. These are usually transmitted to the systems analyst who then attempts to deal with the requests. The push for the development of the system comes from the user: system development is user driven. The technical team facilitates the demands of the users. The users through their experience with the system and the information demands of their jobs, are able to provide useful suggestions as to the manner in which the system can be developed.

Mastery of the system can also be gauged by the users reactions to problems. On two occasions during interviews, the programme appeared to malfunction. Two of the users

immediately tried to establish what was the cause of the problem and the possibility of solving it themselves. On one occasion it was a false alarm and on the other, a change had been made by ISD staff which had not been communicated to some of the users. Also the Data Processing Officer is confident enough to make minor alterations, to both hardware and software, once given instructions from ISD. All the users were confident that most of the problems that presently emerge can be handled in-house. This was confirmed by the System analyst who said that he visited Aquaculture less than before and mostly to make major alterations to software.

Attempts at in house maintenance suggest that learning of the technology has occurred by the users. Technological learning is used to mean the transfer of know how and skill to the users. The users, in performing in-house maintenance, illustrate that they feel they know enough about the system and its operations. This in-house capability has been nurtured by ISD as they allow the users to take the initiative and provide their own solutions to technical problems.

The educational background of the users could also have assisted in use of the technology. Three of the users had tertiary level training in technical sciences (agriculture and marine biology), two others had post secondary technical qualifications, one other trained in Accountancy. The training of the users therefore gave them an orientation to technical applications and systems. This may have helped in the embrace of the new technology.

The utilization of the Pond Management system supports the proposal that high level user involvement in decision making type systems tend to have high utilization rates (Hawk and Dos Santos, 1991: 316-327). The decision making system did demand heavy input from the users and so created a system that adequately addressed the users needs, promoting this sense of ownership and mastery.

This sense of ownership and mastery of the system has ensured that the development of the system is led by the users and the technical department is now primarily a facilitator of the use of IT. The development of an in-house capacity to perform routine and minor alterations and maintenance to the computer hardware and software by the users, further reinforces this facilitative role.

5.4.1.4 Strong Financial Commitment to IT

The level of the financial commitment that has been allocated to the IT effort can be gauged using both capital and recurrent expenditure on IT and IT peripherals and

services. IT expenditure for the past three financial years are outlined in Tables 5.2 (a) (b) & (c) below.

From the Table 5.2 (a) it is noted that capital expenditure for IT has been increasing for the period under consideration. This illustrates the company's commitment to improving the hardware being used through out the organization. The category includes the cost of having to install support mechanisms such as Uninterrupted Power Suppliers's (UPS). The increase is even more vividly represented when it is noted that Capital expenditure on IT has expanded from 3.3% in 90-91 to 14.0% of total capital expenditure in 92-93. This increase, however, may more be reflecting rising cost of computers, due to the sharp devaluation of the Jamaican dollar within the last two years, rather than new acquisition of equipment.

A similar trend is noted in the recurrent expenditure. All the products and services in this category are bought in the domestic economy and provided mainly by ISD. Since cost of ISD services have only increased in the last financial year under consideration, then the rise in recurrent expenditure for the previous two years can be attributed to repair and maintenance for a greater number of hardware units. The percentage increase of IT Recurrent Expenditure between Financial Years 1991-1992 and 1992-1993 (from 0.9 to 2.0) may be attributed to the greater cost of ISD services.

Table 5.1(c) compares the IT expenditure against the sales of the company. The comparison is significant since one study noted that most South Korean firms (where IT diffusion is fairly advanced) invested less than 0.1% of total sales to IT development. In fact *only 14% of the firms allocated more than 0.5%* (Mody and Dahlman, 1992: 1709). In the past two years, the ratio of IT expenditure/sales at Aquaculture has been over 0.5%. Such levels of expenditure can therefore be considered quite high and on par with the heaviest users of the technology in South Korea.

The conclusion to be drawn is that given the firm's resources, the expenditure on IT can be considered significant, illustrating that financial strictures was not a problem in Aquaculture's IT effort.

TABLE 5.2 (a)

**CAPITAL EXPENDITURE ON IT AND TOTAL CAPITAL
EXPENDITURE. 1990-1993**

Expenditure	Financial Year		
	1990-1991 (J\$)	1991-1992 (J\$)	1992-1993* (J\$)
Capital Exp. on Computer Equipment	30 965	273 721	149 925
Total Capital Exp.	920 611	2 558 180	1 050 627
% Cap. Exp. on Computer of Total Capt'l Expenditure	3.3	10.7	14.2

TABLE 5.2 (b)

**RECURRENT EXPENDITURE ON IT AND TOTAL RECURRENT
EXPENDITURE. 1990-1993**

Expenditure	Financial Year		
	1990-1991 (J\$)	1991-1992 (J\$)	1992-1993* (J\$)
Recurrent Expenditure for Comp. Services.	62 101	179 006	292 023
Total Recurrent Expenditure	14 402 990	19 915 019	14 962 731
Recc't Exp. on Computer as % Total Recurrent Expenditure	0.4	0.9	2.0

TABLE 5.2 (c)

**TOTAL EXPENDITURE ON IT
AND TOTAL FISH SALES. 1990-1993**

	Financial Year		
	1990-1991 (J\$)	1991-1992 (J\$)	1992-1993* (J\$)
Total Fish Sales	21 390 844	30 897 207	39 861 741
Total Expenditure on IT	93 066	452 727	374 432
Total Exp. on IT as % of Total Sales	0.4	1.5	0.9

* This figure is obtained from the unaudited Financial Statements for 1992-1993.

Source: Financial Statements of Aquaculture Jamaica Ltd. Respective Years.

5.4.1.5 Innovativeness

Innovativeness is a feature of the group as a whole. This made the move to IT easier to accept. The commitment to innovation is illustrated by new techniques and processes in the operations of the group, particularly in the poultry division, by support for research and development (R & D) and a willingness to be researched.

The poultry division, as noted, is by far the main operations of the group. In the growing of chicken, the company boasts of having developed a new technique to feed male and female breeders separately in the same house, a practice that has become a standard in poultry growing industries throughout the world. The group has also commercially applied biofermentation; a process of converting agricultural waste into a stable feed source.¹⁴ Even the method of contract farming, which has been used successfully to produce the broilers and was introduced in the growing of fish, is an innovative production practice in the Jamaican context.

There is also a great deal of support for R & D by the

¹⁴ C. R. Aldridge "Jamaica Broilers Share Issue: A Product of A New Jamaica," *Money Index*, #321, May 26, 1992. p 44.

group. The research projects range from working jointly with the University of the West Indies Biotechnology Centre to support for in-house R & D at the various farm facilities.¹⁵ Even this study was welcomed and recognized as being very useful to the company. The company is open to research and to new ways to solve problems; a culture that fosters and encourages creativity.

Aquaculture itself proves that the group was willing to experiment in producing a product for which they had very little expertise in previously and which had not been attempted previously in Jamaica, on such a scale. The form of production was alien to Jamaica and so they learnt from the Israelis who built the first phase. From the second phase of ponds, the company realized, by accident, that the "flow through" system allowed faster fish growth and this process was replicated in the third phase of expansion. The commitment to learn and improve is apparent. These activities suggest that the group's senior management is committed to being pioneers in their particular areas. Change and innovation was appreciated and not discouraged.

This atmosphere impacted on the IT effort. Levy was willing to invest in a computer unit and attempt to see if the technology could help solve problems. He became convinced of its usefulness and promoted adoption and utilization. At Aquaculture, there was a similar sentiment; when the problem of managing the data occurred, IT was seen as an option and the company was willing to invest in the effort. Within this culture of acceptance of innovation and new ways of performing, the utilization of IT was facilitated.

5.4.2 Inhibitors

5.4.2.1 Locational Problems

a) Poor provision of electricity

The electricity supply to the area is irregular, with fluctuations in the voltage occurring frequently. During the researcher's visit to the site, the power supply failed on three separate occasions in one day. During one of these outages, some data was lost by one of the accounts clerks. Three of the users were able to give examples of occasions when data was completely lost due to these

¹⁵ See Appendix 2 of M. Witter "The Poultry Industry in Jamaica: The Impact of the Reform of the Common External Tariff (CET)," 1992. A report prepared for Jamaica Broilers. This contains a listing of research projects that have been carried out.

outages. To protect themselves, and the information in the system, the company has had to invest in six Uninterrupted Power Suppliers (UPS) to provide electrical power backup. (See Appendix 5 for listing of the IT and related equipment at Aquaculture).

b) Poor provision of telecommunication services

There are no direct telephone lines to the area. Communication with the head office and other parties is done primarily through the use of radio. Recently there was the installation of a cellular service to the company. This service must be heavily controlled due to the high cost of using this form of telecommunications.¹⁶

This lack of telephone lines impacts negatively in two ways. Firstly there can be no on line link with the other companies in the group through wide area network (WAN). Information that is to be passed between Head office and the Aquaculture must either be sent through the radio (cognizant of this medium's lack of privacy) or be carried physically from one location to the other which can cause delays in the relay of necessary information. The availability of a WAN could facilitate easier consolidation of group accounts and even allow for system maintenance to be performed from Kingston without the physical movement of the Systems analyst. This can reduce the time taken to rectify software problems.

c) The farm environment

The peculiarities of the farm environment is another factor that makes the use of the technology difficult. The primary difficulty is the dust which pervades the production area. In this case, the dust comes mainly from the loose material that covers the roads between the ponds. These particles get into the main building where the computer equipment is located, despite the best preventative efforts. While the entire main block is air conditioned, the continuous opening and closing of the door allows the dust to get indoors, and into, the computers. The result has been greater maintenance than is normally needed in a relatively dust free environment.

There is also the peculiar problem of lightening. The area in which the ponds are located is prone to strikes

¹⁶ The cost of a call via a cellular telephone, from Aquaculture to the Kingston office is \$5.50 per minute. On the regular digital exchange the cost would be \$1.88 per minute. This information was obtained from the Telecommunications Company of Jamaica (TOJ).

from lightening. This electrically charged environment has caused the system to go down on three occasions.

The locational problems can be discussed in two categories. The first category can be termed "*infrastructural deficiencies*." This will include the poor electricity and telephone service. The other category is the "*site specific*" issues that arise which will include the remoteness and farm environment factors.

The infrastuctural deficiencies suggest areas where government policy can aid in the utilization of the technology. A reliable electricity supply is essential to the use of computer technology. Besides the loss of data, there is the possibility of serious damage being done to the hardware. This would make the risks of using the technology higher as well as increasing the initial cost of using the system since additional equipment (such as UPS's) would have to be purchased (Munasinghe, 1989: 19). This may ward off potential users. Modern telecommunications is essential to exploit fully the advantages of IT. In fact, one study shows a positive correlation between the number of telephone lines in use and the degree at which IT is used.¹⁷ While the inadequate infrastructure may be less of a problem in the urban areas, the rural areas need efficient services if companies with rural production facilities are to be encouraged to invest in IT.

Site specific problems are those that need to be considered by the company in the planning stages of the system. Any company wishing to utilize IT should take cognisance of the physical environment within which the technology is to be used and ensure that it is conducive to hardware operations. In the case of Aquaculture, the problem of dust was not obviously considered but it did impact of the functioning of the hardware. The use of computer technology requires some basic physical conditions (eg. dust free environment, an area free from vibration and relatively cool temperatures) in order to operate at its optimum. Therefore, part of the planning process at the firm level that should occur is the provision of appropriate physical conditions.

¹⁷ Mody and Dahlman (1992), citing The 1992 Computer Industry Almanac, were able to illustrate that there was a strong correlation between the use of telephones, televisions and computers.

5.4.2.2 The Lack of Documentation of IT effort and Systems

Increased demands on ISD for IT services are creating problems of lack of documentation for systems developed and delivered. This can have critical long term implications for future systems development and diffusion.

The department is always in a backlog position since it appears to be swamped with requests for new systems or for modifications on existing systems. This has led to two problems. Firstly, and less critically, there is a long timelag between the time that the request are made and the time the system is actually delivered (response time is very long with work pending up to a year). Secondly, and more importantly, as a result of all the work to be done, some "short cuts" need to be taken as programmes are rushed through. These short cuts can (and usually does) take the form of poor or non existent system documentation.

The staff at ISD admitted there is lack of user documents and technical support documentation. A search by the researcher for some form of documentation on the Pond Management and Accounting System, both at Aquaculture and at ISD, proved fruitless. All the information on the developments that had occurred in the implementation of the IT system, in the group and at Aquaculture, had to be obtained from the persons involved in the process as no documents were available. This lack of procedural and other support documentation means that there is still a heavy dependance on the system developers for assistance even when the systems are delivered to the users.

Lack of documentation has been shown is an inhibitor in the utilization of technology generally. This is illustrated by a study (Boodraj, 1992: 112-117) done of a soap manufacturing plant in Jamaica in which one problem observed in the company's attempt to use new machinery in the plant was the lack of proper documents and manuals. This led to the situation of the abandonment of some of the machinery as the workers were unable to reassemble the machines that had been dismantled for maintenance; no guide was available as to how the machine was assembled. Documentation is critical as it is a major means of 'technological learning' for users of the technology.

Barrio and Parisca (1983b) in a study of technological assimilation in an aluminum smelter plant in Venezuela, suggested that the documentation of all procedures is a major step to capturing the knowledge created in the daily operation of the technology. Technological learning cannot be viewed as an automatic, passive process (Hoffman & Girvan, 1990: 36-37) but rather the users need to be

proactive; consciously instituting measures that will enable data created to be collected and understood. Documentation of procedures such as the "start up experience" and the initiation process will allow for the "systematization of operational information." (Parisca and Barrio, 1983b: 14). Such operations provide insights into innovations or modifications that may have occurred at these stages of the operations which can aid in future technology efforts.

The existence of such documents can also serve as a record of maintenance and modification performed on a particular system over time which might be important when the initial users are no longer involved. Documents are able to record experiences that future users and technical staff can use to avoid similar mistakes. The experience, gained by developing and utilizing the Pond Management system, is lost if not properly documented.

Without documentation, there is the problem of important historical system information being personalized. Personalization of information can be problematic for two reasons. Firstly, while staff turnover at the department appears not to be significant, persons who may leave the department will take detailed knowledge of the systems for which they were responsible and when attempting to transfer knowledge of the system, it is invariably done verbally. In the case of the present Systems analyst, his predecessor had only two weeks to demonstrate and pass on most of the information and knowledge he had acquired by working with the system. This time is rather short and it can be assumed that the transfer of information was far from optimal.

Secondly, it hinders the benefits that can be obtained through having flexibility within the organization. Since teams are not involved in working on the various system, and in the absence of documented technical procedure, only the individual who works on the system has in-depth knowledge of the system. If this person is not available then prompt action is retarded. Alternative personnel, while willing to assist, may be unable to provide help.

Events have recently occurred which may alleviate the lack of documentation problem. With the mandate to operate as a profit centre, greater control is exercised in the recording and monitoring of jobs performed. As a result, ISD has installed a job monitoring system into which particular jobs are entered and assigned to a person. All work done in relation to this job is noted and the various costs calculated. In the process, some documentation of systems is created; persons can, in the future, easily establish what work has been done on a system thereby

depersonalizing some of this information. Also a person on contract from England has been assigned the responsibility of the production of documentation of existing systems. A recent move into new physical premises has, ISD staff claimed, removed one of the main constraints on manpower increase; there simply was no room to put more persons. At least two new persons are to be hired which may alleviate the rush to deliver services to the users at the expense of providing proper documentation.

5.4.2.3 Lack of Formalization of the IT strategy

While there has been the goal of ensuring the use of IT by the top managers and group support, the planning and implementation of the effort has proceeded in a very informal manner. This informality is observed by the lack of an IT project team responsible for supervising the effort and of a stated organizational IT plan.

Informality best describes the manner in which the planning for introduction and changes to the system are arranged. There are no project team or IS committee responsible for either managing or steering the IS effort, for providing plans for system development or for evaluating the extent to which the system has fostered efficiency or productivity gains. The IT implementation literature has identified project teams as one means of incorporating the users and the technical staff into a planning body and providing participation in the effort. Walton noted that at the stage of systems design, a group formed from the critical stakeholders can

"provide expertise, promote a sense of shared ownership, and confer credibility or authority on the systems development effort" (Walton, 1989: 150).

Crescenzi suggested that for project teams to be effective they should consist of six to eight members and should include experienced change agents (persons who generally affect change within the organization) as well as persons who will be able to facilitate the necessary organizational changes (Crescenzi, 1988: 17-18).

This form of team approach to systems implementation has been used in the Caribbean as in the case of a large multi national firm in the chemicals and process industry in Jamaica (Girvan & Marcelle et al, 1993: 152-155). This company has successfully managed to create a variety of teams with responsibility for the IT effort and the organizational changes expected to occur.

At Aquaculture, project teams were, and are, not used.

It was not possible to identify a person or body in whom rests the responsibility for the effort and the articulation of goals. Technical and user interface occurs through informal channels. As users see fit, they suggest to the technical staff, either over the telephone or when such personnel visit the site, problems or issues which the particular user think pertinent. Demands are channelled directly from the users to the technical staff. The manner of planning is by informal recommendations to the technical staff; formal IS meetings do not occur. This may not have such an impact given the system and the number of users, but system change occurs in a vacuum without stated goals.

Additionally, there is no formal record of an IT plan for the organization. The researcher could not locate any documents containing the goals and objectives guiding the effort; in sum there is no IT strategy. The development of the system proceeds in an ad hoc manner with users making demands on the technical staff as issues arose. At present, the systems throughout the group are not fully integrated and the individual systems are in a sufficiently nascent stage to allow for ad hoc development. However, as the group systems becomes more integrated, as wider networks are created and as the technology is used increasingly as a means to gain competitive advantage, the need for formal systems plans is bound to increase.

While there does exist a plan for ISD for the financial year 1993-94, there does not appear to exist individual company plans (See Appendix 6). The ISD plan, however, is vague and the articulation of specific goals and objectives are not given. Even when group directives on IT are given, it is performed verbally; usually passed on in meetings with senior group and company management.

Plans are needed both to control and guide the development of the system. A formal plan should be able to integrate and priorities the demands of various stakeholders, given the technical, hardware and user constraints. Such formal plans, however, should not stifle creativity and formalize every action but top management can establish parameters within which IT activities can proceed. An example would be the standardization on the Dataflex platform that will allow for easy group system interface and networking. This directive has been issued by senior management (no documentary record of this directive could be found). However, given this parameter, the users and the system developers can work on applications to suit the needs of the users. Therefore, plans are needed to clearly articulate the IT goals of the group, while being sufficiently flexible to allow the needs of the users and programmers to be included. The plan can also form the basis for evaluation at the end of a period.

This lack of formalization in the IT effort is one of the main problems expected to inhibit the development of the system. While steps are in the works to improve on the state of documentation, the loss of knowledge and experience will be difficult to recover.

SECTION 6

CONCLUSION

Aquaculture Jamaica Ltd. represents a firm operating with complex production information needs and in a volatile economy, heavily dependent on external technological and finances. Within this context, the application and utilization of IT proceeded and the analysis above suggests a number of issues that should be addressed in such an application effort.

The impetus for use were from factors that were totally internal. Sabherwal and King (1991), in attempting to build a theory to explain the strategic use of IT by firms, have suggested that one criterion to attaining a high competitive advantage from the use of IT is that the process initiation should be "opportunity triggered" rather than "crisis or problem oriented" (cited in Girvan and Marcelle, et al., 1993: 22). At Aquaculture, process initiation was problem driven; a reaction to the pressure to manage vast amounts of data as the production facilities increased. The technology was not used in a proactive manner to develop strategic advantage; to gain on competitors or produce new products as the company was existing a virtual monopoly position. The effort was a labour saving, paper reduction activity used to support managerial decision making. There are indications, however, that as the group uses the technology more extensively and learns of the advantages to be gained, then the use of the IT as a competitive weapon may increase. This is the case with the new units to be installed in sales vans that should allow for sales data to be provided to management quicker. This can permit quicker responses to changes in the poultry market. In this case, the technology is being used for competitive purposes. The expertise to use such systems has been obtained by the application of systems like the Pond Management system.

The facilitators confirm the suggestion by Walton (1989) that the involvement and support of critical stakeholders in the initial stages of systems development and utilization is important to the success of the effort.

At Aquaculture, the critical interest were top management (both group and company), technical services and the users. The IT effort was such that all three critical stakeholders were involved and interested in the use of the technology within a general corporate environment that encouraged innovation. This ultimately provided the support for, and utilization of, IT.

However, this case appears to question the conventional project team approach to IT deployment and management that is assumed in the literature (eg Crescenzi, 1988; Walton, 1989) as the main vehicle means to including all the critical interests. While structures may be important for control purposes, it may also be not entirely necessary, once the role that IT teams would perform is otherwise carried out. Such structures may be substituted informally. At Aquaculture, the manner in which the technical staff approached system design and operation ensured that the participation by the users (the main goal of IT teams) was achieved. Therefore, the case illustrates the point that the method of IS implementation may vary, with a need to take cognisance of the organizational environment in which the change is to occur. Once the effort ensures involvement and participation of all affected parties, formal structure may be unnecessary at such time.

This is not to intimate that project teams will never be needed or used in IT application at Aquaculture or at the group level. Rather, the point is that the process of application has to be dynamic, constantly responding to the changes that are occurring in the organization and to the new IT demands. As the applications across the group grow and as the demands placed on ISD increase, there has to be a change in the manner in which the technical services are provided. In the initial stages, the informal, unstructured approach could have operated but, as the systems get older, and the staff and personnel that worked on the program move on, there is an increasing need to re-examine the role of ISD and the approach to deployment and development. It may be at this point that project teams would be needed to facilitate the interface between the users and the technical staff. The manner of delivery of the IT services should therefore be a function of (amongst others) the state of use of the technology in the organization, the nature of the systems in use, the length of time the systems are in operations and the extent of IT personnel available. System development and deployment practices should be harmonized with the existing organizational environment and structures in order to establish the best IT strategy needed for the situation.

Another issue that emerges from the research is that

the IT effort should be viewed as a process; not a static, passive event. The studies, such as King and Grover (1991) on IT application, all appear to assume a definite IT intervention, the success of which is dependent on factors existing at the time of the intervention. This case study illustrates that IT application should be studied as a process; using the categories of short and long term. The short term factors appear to relate to those that have traditionally been studied in the IT application literature (eg. top management support, strong technical support and financial commitment). However, as the process of application proceeds, other factors can emerge that may adversely affect the continued development and relevance of the Information system to the needs of the users. IT application is a dynamic process that undergoes changes with differing factors being important at differing times. Analysis of the effort should take cognizance of this and attempt to understand the effort over time.

The critical finding is the poor state of documentation in the case of an IT effort. While this is a common occurrence in technology transfer of other forms of technology (as noted by Parisca and Barrio, 1983; Boodraj, 1992), Aquaculture provides evidence to show that this can also occur with IT efforts resulting in similar problems of difficulty to learn from past mistakes as well as lack of history of alterations and modifications made to new technology. The point to be made is that IT application should not be detached from the issues that are common in the application of imported technology generally in firms in developing countries like Jamaica. Many of the problems that have occurred due to the lack of a dynamic approach to learning and acquiring knowledge from imported technology, are relevant to IT; the lack of documentation is symptomatic of this passive orientation to learning.

The analysis also shows that there remains in the application of IT the element of an orientation to innovation and creativity that must be exhibited by the recipient firm which will facilitate not only information technology, but rather technology in general. The move to IT was prefaced by a willingness to try a new and unfamiliar solution to a problem that was slowly growing. Following the adoption of IT, there was a commitment to support, both by providing the necessary human and technical resources. The issue is that the organizational culture must nurture innovation since, in such a business environment, IT may be more readily accepted and utilized.

Thus we may claim that the reason the effort to IT has been successful thus far was because the factors that could be expected to be critical in the initial phases were in place and adequately managed. The facilitators apply

directly to the initial stage of the utilization process: the design, the deployment and the initial period of use. In the short term the facilitators have ensured that the IT effort was successful. However as the system attempts to expand (driven by the users), attempt to integrate with systems outside of Aquaculture, then the inhibitors mentioned can be expected to become problematic. The inhibitors point to longer term constraints on the system.

6.1 Implications of the study for Future Public Policy Initiatives

Emerging from this study are a number of issues that may need to be addressed by the government in order to facilitate the adoption of IT.

In the first instance the government needs to have a coherent Information Technology policy that serves to foster the use of IT within the society as a whole. The experience of economies such as Singapore resulted from direct government action that sought to "informate" the entire society (Seng Hon, 1992: 1817-1828). A non active stance, which exists at present, will not ensure rapid utilization of the technology within the economy. Organizations cannot be assumed to know of the various ways and means that computer technology can aid in their production and drive to efficiency. The promotion of IT use can be achieved by the use of fiscal incentives such as provision of tax breaks for firms that spend a given amount of their capital budget on IT. Another measure may be to attempt to educate the private sector on the uses to which IT can be put in their various organizational processes.

A related point is that government can seek to utilize existing groups such as the Jamaica Computer Society to promote the use of the technology and inform interested parties of some of the possible problems that can be encountered. There are capabilities existing within the society that have both the ability and the credibility to aid in the diffusion of IT. The government, in collaboration with such social actors should attempt a diffusion thrust focused on training and the provision of IT related information. Training should be provided both at the secondary and tertiary level. The Jamaica Computer Society Education Foundation has been attempting to provide such training. This capability and initiative should be supported and encouraged (Girvan, Marcelle, et al, 1993: 224). Information on matters such as the uses to which IT can be put and the benefits that may be forthcoming in using IT can ensure that more firms begin to apply the technology creatively. IT investments can be made from a more informed position.

Concomittant with any support for information technology use must be policies that seek to improve and enhance the infrastructural support necessary for IT utilization. As was noted, one main problem at Aquaculture was the locational problems of poor electricity services and non availability of telephone lines. If these services are not efficient it can be expected to retard IT use. While this might not be as great a problem in the urban setting, it still illustrates the constraints that can occur, were these systems inadequate. Government must ensure that these systems are sufficiently maintained and enhanced to allow IT diffusion.

6.2 Suggested Future Research

Given the fact that this is a greatly under-researched area, there exist quite a number of areas where future investigation would be useful. Following will be list of what the researcher thinks to be the more pressing areas.

Many more case studies need to be done, examining the implementation of IT in the region. These should have as their goal, the development of a theory of IT application and more generally, of technological change in the region. Research will also have to take on a more region scope, attempting to provide comparative analyses of IT efforts across countries in the Caribbean. Comparative research on sectoral application, application in social services as opposed to economic subsectors and application by firms of differing ownership structures and size would all provide useful information on the state and process of application in the region.

Investigation of application in the manufacturing sector is also important. Such applications are limited in the Caribbean context but are critical if the full potential of the technology is to be realized. How such applications have come about, the nature of the problems encountered in IT application and the production gains that accrue to these manufacturing companies need to be investigated.

Also of interest is the role of the champion in the utilization of IT. There is need to identify the various individuals in different companies who have championed the cause of IT and aided in implementation. In-depth investigation of individuals who champion the IT cause can indicate the attributes of individuals best able to lead the IT effort and promote successful implementation.

Finally, despite the attendant difficulties, there is need to quantify the benefits that have been gained by the use of IT within the Caribbean. The hypothesis that IT use

has increased the firm level efficiency and competitiveness, needs to be tested empirically. Such studies will provide statistical proof of the technology's usefulness.

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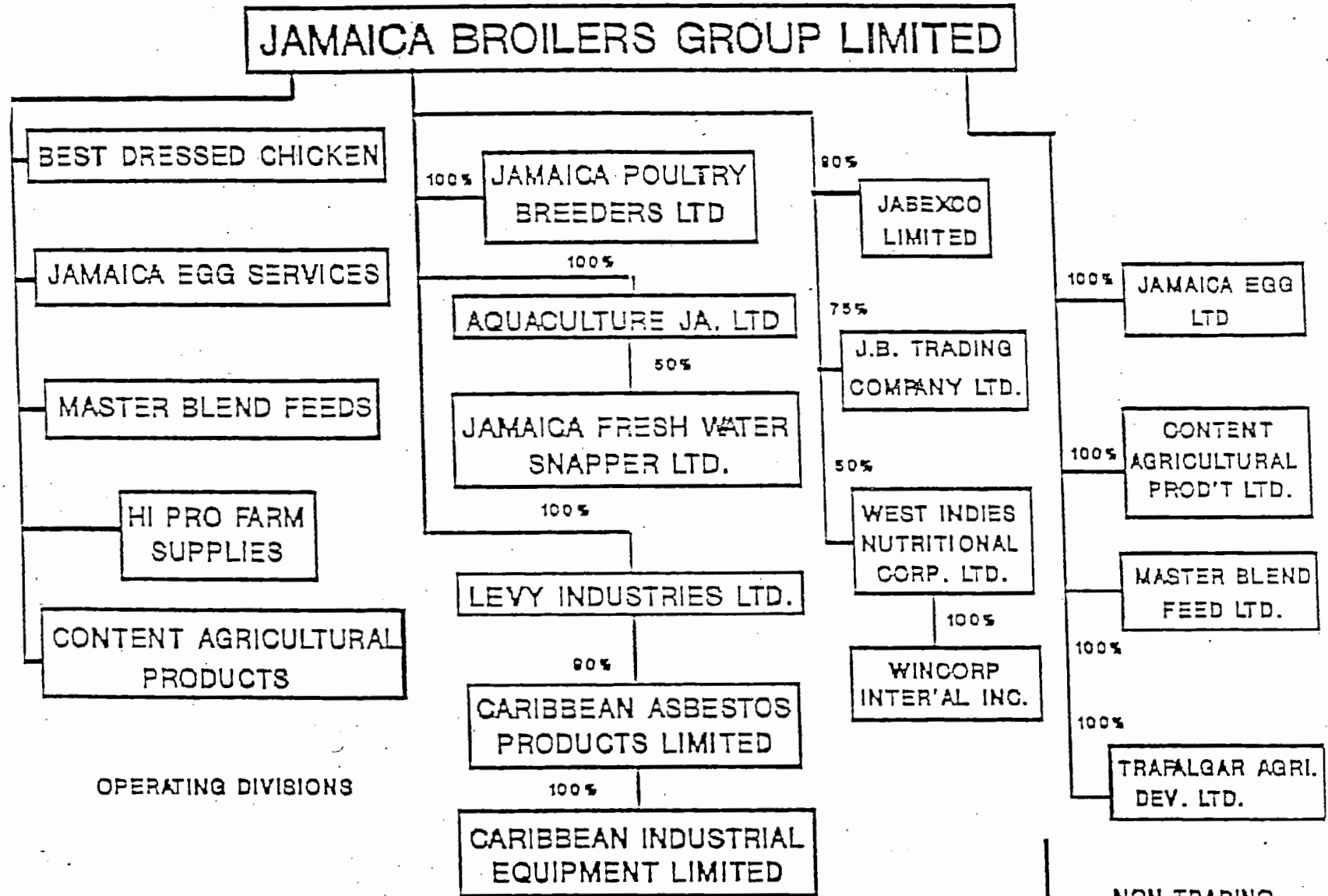
APPENDIX 1

Financial Years 1989-1993
Aquaculture Jamaica Ltd. and Jamaica Broilers Group Ltd.
With Periods Labelled Consecutively

Financial Year 1989\90			Financial Year 1990\91		
Period	From	To	Period	From	To
1	30-Apr-89	27-May-89	27	28-Apr-91	25-May-91
2	28-May-89	24-Jun-89	28	26-May-91	22-Jun-91
3	25-Jun-89	22-Jul-89	29	23-Jun-91	20-Jul-91
4	23-Jul-89	19-Aug-89	30	21-Jul-91	17-Aug-91
5	20-Aug-89	16-Sep-89	31	18-Aug-91	14-Sep-91
6	17-Sep-89	14-Oct-89	32	15-Sep-91	12-Oct-91
7	15-Oct-89	11-Nov-89	33	13-Oct-91	09-Nov-91
8	12-Nov-89	09-Dec-89	34	10-Nov-91	07-Dec-91
9	10-Dec-89	06-Jan-89	35	08-Dec-91	04-Jan-92
10	07-Jan-89	03-Feb-89	36	05-Jan-92	01-Feb-92
11	04-Feb-89	03-Mar-89	37	02-Feb-92	29-Feb-92
12	04-Mar-89	31-Mar-89	38	01-Mar-92	28-Mar-92
13	01-Apr-89	28-Apr-89	39	29-Mar-92	02-Mar-92

Financial Year 1991\92			Financial Year 1992\93		
Period	From	To	Period	From	To
14	29-Apr-90	26-May-90	40	03-May-92	30-May-92
15	27-May-90	23-Jun-90	41	31-May-92	27-Jun-92
16	24-Jun-90	21-Jul-90	42	28-Jun-92	25-Jul-92
17	22-Jul-90	18-Aug-90	43	26-Jul-92	22-Aug-92
18	19-Aug-90	15-Sep-90	44	23-Aug-92	19-Sep-92
19	16-Sep-90	13-Oct-90	45	20-Sep-92	17-Oct-92
20	14-Oct-90	10-Nov-90	46	18-Oct-92	14-Nov-92
21	11-Nov-90	08-Dec-90	47	15-Nov-92	12-Dec-92
22	09-Dec-90	05-Jan-90	48	13-Dec-92	09-Jan-93
23	06-Jan-90	02-Feb-90	49	10-Jan-93	06-Feb-93
24	03-Feb-90	02-Mar-90			
25	03-Mar-90	30-Mar-90			
26	31-Mar-90	27-Mar-90			

The Corporate Structure of Jamaica Broilers Group Limited.



Source: Jamaica Broilers Group Ltd.

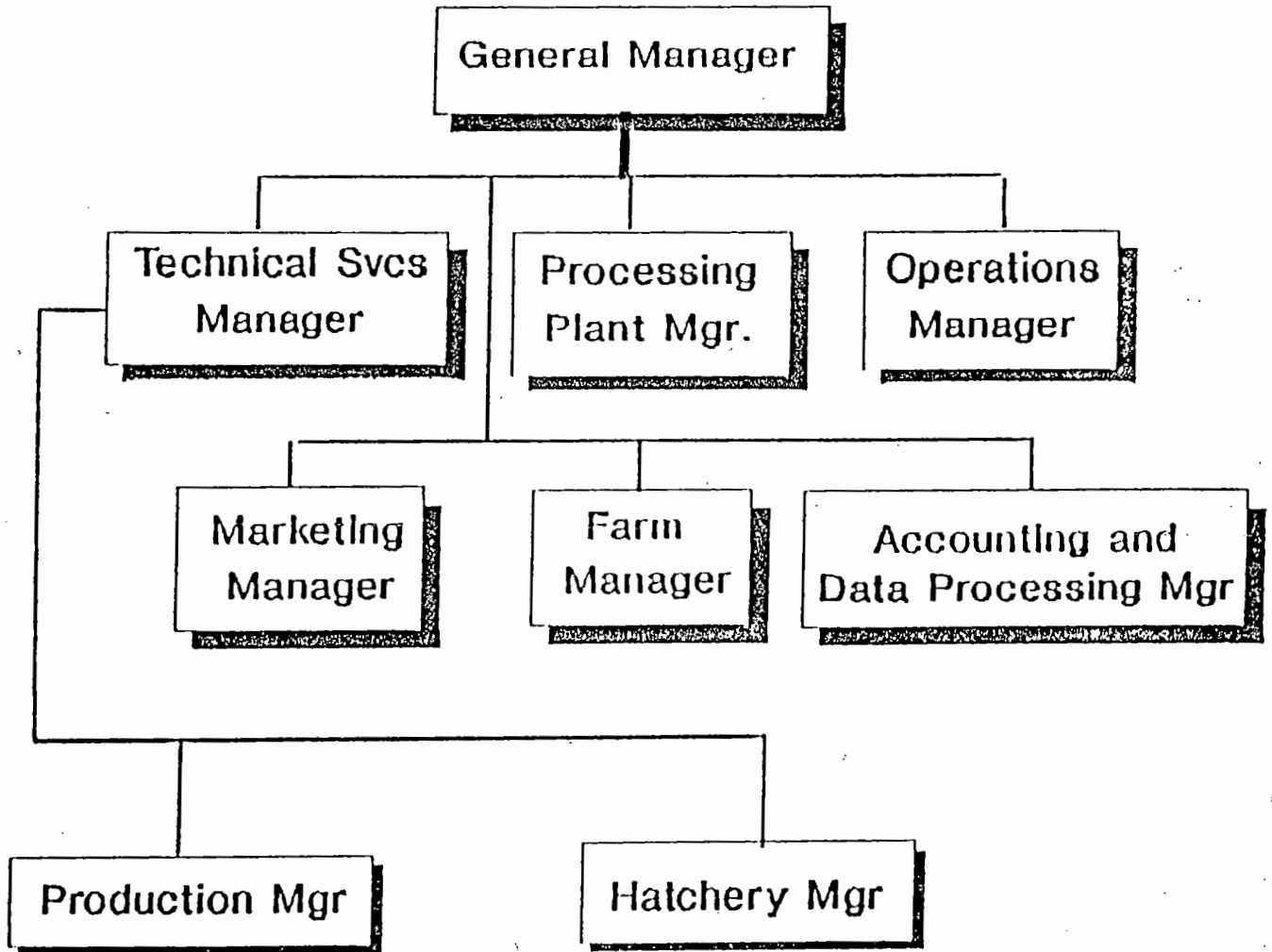
Prospectus: 1982 Share Issue.

TRADING SUBSIDIARIES

NON TRADING SUBSIDIARIES

APPENDIX 3

The Organisational Structure of Aquaculture Jamaica Limited



Source: Aquaculture Jamaica Ltd.

APPENDIX 4

List of the persons interviewed

Name	Position
Head Office	
Mr. R. Levy	Co-Managing Director, Jamaica Broilers.

Aquaculture Ltd.

Dr. F. Ross	General Manager
Mr. C. Salmon	Operations Manager
Mr. J. Carberry	Technical Services Manager
Mr. D. Thompson	Production Manager
Mr. F. Rowe	Hatchery Manager
Mrs. D. Ingram	Accountant
Mr. A. Daly	Production Assistant

**Information Systems Department,
Levy Industries Ltd.**

Mr. S. Delaphena	Manager
Mr. I. Persaud	Senior Systems Analyst

Mr. C. Nehemiah

Master Blend Ltd.

Mr. W. Cammock	
Mr. H. Harris	
Mr. C. Williams	

APPENDIX 5LIST OF THE COMPUTER HARDWARE EXISTING AT AQUACULTURE LTD.
AS OF 18 MARCH, 1993.

<u>EQUIPMENT</u>	<u>MODEL #</u>
FILE SERVER	Exo-2804A-00X
EVEREX 180A AT COMPUTER	
EVEREX 3000 AT COMPUTER	
LCD PORTABLE 286	12 MHZ
SYSTEM	1700 C
SYSTEM	1700 C
SYSTEM	1800 A
SYSTEM	1800 A
EVEREX	1700
SYSTEM NOTE MASTER 3865-16	
MINRONIX 386 SX MINI TOWER	

PRINTERS

PANASONIC	KXP1695
PANASONIC	KXP1695
EPSON FX1050	
EPSON FX1050	
EPSON FX1050	
EPSON FX1050	
EPSON EX800	
OKIDATA	ML193
EPSON FX1050	

MONITORS

SAMSUNG	MA2565
SAMSUNG	MZ4571
SAMSUNG	MA2565
SAMSUNG	MA2565
SAMSUNG	MA2565
SAMSUNG	MA2565
SAMSUNG	MA2565
SAMSUNG	MA2565
LEADING TECHNOLOGY	LTI-125A
LEADING TECHNOLOGY	

POWER PROTECTION

POWER SUPPLY	CBS1120
POWER SUPPLY 1200VX	
AMERICAN POWER 1200VX UPS	
AMERICAN POWER 1200VX UPS	
APC UPS	

ONERC

CP 1108

APPENDIX 6

An Example of a Pond Card Produced by the Pond
Management System, Aquaculture Jamaica Ltd.

Run Date 14/04/93

CROP RECORD
AQUACULTURE JA. LTD.

POND T02 AREA 2.00

BATCH 92OTO21OF PURPOSE PHASE 2 GROWOUT DURATION 155

STOCKING

DATE	NO.	TOT.WT.	AVR.WT	AGE	SOURCE	TRAN#
16/05/91	28228	4116.0	145.81	162	91OG1320F	4948
17/05/91	1718	235.2	136.87	163	91OG1320F	4954
16/05/91	2654	403.0	151.90	157	91OJ2230F	4950
17/05/91	11971	1428.0	119.28	122	91OT1520F	4956
TOTAL	44571	6182.4	138.71			

HARVEST

DATE	NO.	TOT.WT.	AVR.WT	AGE	DEST'TN	TRAN#
01/10/91	9177	2603.7	283.7	137	SALES	5779
07/10/91	5562	1408.5	253.2	143	SALES	5785
08/10/91	12444	3170.9	254.8	144	SALES	5789
09/10/91	7304	1961.2	268.5	145	SALES	5791
10/10/91	5513	1567.0	284.2	146	SALES	5793
TOTAL	40000	10711.4	267.8			

KG/DAY 31, FEED 15413, FCR 3.40, %SURV 89.74,
%MALES 100.0, G/D 0.88.

ACTUAL DURATION 146

SAMPLE DATA

DATE	DAYS	TOT WT	NO.	AVG.WT	G/D	COMMENTS
08/06/91	22	58.0	343	169.0	1.3	
22/06/91	36	66.9	347	192.7	1.6	
06/07/91	50	50.6	255	198.4	0.4	
20/07/91	64	75.5	323	233.7	2.5	
03/08/91	78	71.8	325	220.9	-0.9	RECRUITS
17/08/91	92	74.5	335	222.3	0.1	
31/08/91	106	93.0	380	244.7	1.6	
28/09/91	134	71.3	286	249.3	0.1	

DAILY READINGS

DATE	DO	TEMP	DATE	DO	TEMP
20/05/91	2.1	26	23/05/91	2.2	26
24/05/91	2.4	27	25/05/91	3.0	27
26/05/91	2.1	26	28/05/91	0.0	0
30/05/91	2.8	28	31/05/91	3.2	26

APPENDIX 7

The Goals of The Information Systems Department (93/94),
Jamaica Broilers Group Ltd.

- 1) a) Automated Information for Management

Survey the need/opportunities and then the design and implement query systems for Managers to access computerized data directly:
eg. - Sales/Accounts Receivables
- Bank Account monitoring, and
Bank reconciliations.
- b) Staff

Enhance efficiency of ISD's staff by on-the-job training and special courses. Recruit another Senior Systems Analyst and a Programmer.
- 2) User Documentation

Complete Documentation for:-
- Master Blend's Sales System
- Aquaculture's Pond Accounting
- BDC's Flock Accounting
- Content's Sales System
- 3) a) Analyze, Design and Implement Point-of-Sales devices for BDC's delivery trucks for broiler meat. Start with pilot project of one truck.
- b) Review the efficiency and the appropriateness of the Accounts Payable System, and re-design if necessary.
- 4) a) Flock Accounting System

Re-examine the feasibility of automating all aspects of BDC's Flock Accounting System, with the objectives of closing within 3-4 days after the Period.
- b) 3rd party work

Increase the level of hardware sales, and give more visibility to our 3rd party work. Examine opportunity for US\$ earnings.

April 13, 1993.

THE DIVESTITURE OF THE GUYANA TELECOMMUNICATION
CORPORATION: A CASE STUDY

A Research Paper

Submitted in Partial Fulfilment of the Requirements
for the Degree of Master of Science in
Development Studies

of
The University of the West Indies

Gene Osmund Evelyn
(91/166312)
1993

Consortium Graduate School of Social Sciences
Faculty of Social Science
Mona Campus

ABSTRACT

THE DIVESTITURE OF GUYANA TELECOMMUNICATION CORPORATION: A CASE STUDY

Gene Osmund Evelyn

Throughout its history as an independent nation, Guyana, like developing countries the world over, has relied heavily on public enterprises for the provision of a variety of services. For instance, in 1990, two years after its privatization programme had commenced, Guyana had some 40 public sector enterprises, accounting for 44.4 percent of gross domestic product and 71 percent of total public sector employment.

The privatization programme was initiated in 1988, partially in response to widespread dissatisfaction with the overall performance of the public sector enterprises. Guyana Telecommunication Corporation was among the first of the enterprises to go and much controversy surrounded government's decision to privatize this allegedly lucrative and decidedly strategic public sector monopoly.

This paper argues 1) that it was government's dirigiste philosophy and poor policy choices over the years that led to the telecommunications system becoming backward, highly inefficient, and ineffective, 2) that when this stage was reached privatization became imperative, and, 3) that government's exercise of this policy option was both timely and appropriate.

On the other hand, this paper finds that government sought to escape the burden of good decision-making, in that it failed to explore the myriad alternative ways in which the problems in the telecommunications system might have been adequately addressed. Further, this paper finds that government under-estimated the complexities of regulating a multinational, monopoly operator, and that this error of judgement now threatens to frustrate the pursuit of greater cost efficiency by the new company and to undermine revenue flows to the Treasury.

One of the central conclusions to be drawn from this paper is that, such privatizations as will follow in Guyana - especially of public utilities - will need to be informed by a clear and thorough understanding of the types of problems likely to be encountered and how best might they be circumvented or resolved in the context. Indeed, some of the lessons from this study are general enough to inform the regional privatization dialogue and regional privatization initiatives.

GLOSSARY OF TECHNICAL TERMS

Accounting Rate:- The rate per traffic minute agreed between the telecommunication administrations to cover the cost of using the facilities made available in each country. Usually expressed in either SDRs or gold francs. It comprises:

- a) **terminal share**, of the country where the call originates;
 - b) **transit share(s)** of country through which call passes;
 - c) **terminal share** of country where call is made to.
- Sum (a) plus (b) is **the out-payment** (the amount which the country of origin must pay to foreign administrations) and (c) plus (b) is the **in-payment**.

Call Completion Rate: The frequency (expressed as a % of the total) with which correctly dialled calls are answered (on the first attempt) at the intended instrument or station, unaffected by noise, echo, etc. One can speak of the completion rate for domestic long distance, originating international, and terminating international calls.

Collection Charge: The price a customer pays for use of the service (local or international). Its setting is influenced by such factors as the telecommunication philosophy, socio-economic conditions, the availability of other services, a desire to impose symmetry between applicable charges in both directions of a given traffic stream, and the out-payments from the accounting rate.

Data Communications Networks: A competing data network established via the public network by placing nodes at strategic sites and connecting them by lines leased from the public network. Various technologies (e.g. packet-switching, multiplexing) can then be applied to speed up data transmission.

Dial Tone Delay: The interval in excess of three seconds between a service request (i.e. picking up the instrument) and receipt of dial tone.

Digital overlay network: Refers to a high quality communications corridor (parallel to the existing trunk network) between major cities and business entrepots, aimed at meeting high volume data and/or transmission needs of business.

Earth Station: Sends or receives radio signals in the form of electromechanical waves to or from the earth's atmosphere.

Gateway Exchanges: Also called **international transit exchanges**. They route calls to international destinations.

International Teleport: high-capacity local area networks which serve as international gateways for voice and data traffic.

Microwave Transmission: Transmission of signals using radiowaves with short wavelengths.

Node: A computer controlled terminal in a data communication network.

Paging Network: One used to transmit voice or text, or to signal messages by radio to the holder of a paging unit.

Private Satellite Business Networks: A data transmission link outside of the public network. It is built around an earth stations hub which manages and controls the links between as many as 500 very small aperture terminals (VSATs) scattered at the various user points.

Trunk Exchanges: Also called **transit exchanges**. They route calls between exchanges.

Value-added services: These include, computer-oriented services such as electronic mail and protocol-conversion services (the latter facilitates communication between different computer languages), database access, financial information services, facsimile service.

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SECTION 1

INTRODUCTION

1.1 The Objectives of the Research

This research paper shall be concerned with **divestiture**, one of the many methods used to effect that phenomenon which has come to be described in the literature as "the silent revolution," namely, **privatization**.¹

The objectives of this research paper are to 1) explore the implications of the divestiture of Guyana Telecommunication Corporation (GTC) for the Guyana economy, 2) determine the direct (net) financial impact on the Treasury to date, and 3) assess how the divestiture and its financial impact are likely to evolve over the medium- to long-term.

1.2 Justification For The Study

During the decade of the 1980s divestiture became a major tool of public policy, thereby commanding much of the time and intellectual energy of politicians, public policy designers, and academics in both the developed and developing countries.² If this trend were to continue - and all indications are that it will - then research enterprises directed at analyzing country experiences and the

¹In most of the literature, one finds privatization defined to encompass several techniques for the total or partial transfer of ownership and control of the assets and activities of former State Owned Enterprises (SOE's) to the private sector. The more important of these techniques are: a) asset sales; b) the sale of shares; c) reorganization of an entity into component parts; d) management/employee buy-out; e) lease of assets; f) management contracts; and g) competitive bidding for franchises. If technique a) or b) is effected in a partial way the result is a Joint Venture between government and the private sector. This is what this paper refers to as "**divestiture**."

²The following facts make the point forcefully. The decade saw the advent of new journals dedicated to the phenomenon, a Special Issue of World Development was devoted to the subject, and the International Financial Corporation's Discussion Paper #10 of 1990 lists a total of 41 planned and completed telecommunication divestitures (Asia/Pacific 11, Latin America 14, Africa 12, and the Middle East 4).

peculiarities of the divestiture of specific entities, must be both timely and relevant from a policy perspective.

A perusal of the literature reveals that, especially in the Caribbean, divestiture objectives have been articulated and the policy implemented but no evaluations follow. Ever so often, the bureaucracy, the layman, and, unfortunately, academics voice what amounts to a hunch, that the promised efficiency gains from the divestiture of a given entity have failed to materialize, or that a public monopoly has been replaced by a private one. Other common refrains are that national assets have virtually been given away, and that private operators have been granted so many concessions that their enterprises are guaranteed financial viability. Yet, there remains a conspicuous lack of evidence to support or refute these contentions: a lack of evidence which also makes it virtually impossible to formulate appropriate policy guidelines. The search for evidence is one of the principal tasks of this paper.

This alone could suffice as adequate justification for this research enterprise because many, if not all, of the refrains listed above have been voiced surrounding the GTC divestiture. What is more, the pre-election rhetoric of the political party that now leads the government notwithstanding, it seems beyond dispute that the use of divestiture as a policy instrument will loom large in the foreseeable future. To disabuse oneself of any belief to the contrary, one needs only take cognizance of Guyana's relatively large public sector, the low capacity utilization across the economy, the virtual impossibility of financing maintenance and new investments, the distress signalled by the macroeconomic indicators, and the fact that economic management is being conducted within the confines of an IMF/IBRD Programme designed to include divestiture as a conditionality.

This research is intended to make a contribution, however small, to the lifting of the regional divestiture discourse. It shall illuminate the myriad issues which are inextricably linked with the research question as formulated: the valuation of assets and the methodology used to arrive at sale price, the design and substance of legal instruments, tariff determination, the regulatory framework, the issue of competition, the fiscal impact of the transaction, and the likelihood of government having to retrieve the entity (as has happened elsewhere).

These issues, critical and central to controversy as they are, remain under-investigated. Thus, this research must be both topical and relevant to policy.

1.3 Structure of the Research Report

Section 2 reviews the literature. The methodology is dealt with in section 3. Section 4 attempts to situate the GTC divestiture by presenting a picture of the macroeconomic reality in Guyana over the period 1980-90 and its implications for the telecommunications. This section also presents a wealth of descriptive data and information - both qualitative and quantitative - on the case being studied.

Section 5 is concerned with asset valuation and approaches to arriving at a sale price. Section 6 addresses the crucial and inextricably linked issues of regulation and competition. Section 7 assesses the new company's performance. The section has a dual thrust: 1) to demonstrate that the network can be extremely lucrative, and 2) to evaluate progress to date on the expansion and improvement programme agreed between government and the foreign joint venture partner. Section 8 undertakes a crude assessment of the direct (net) financial impact of the divestiture on the Treasury. Section 9 embodies a summary findings and the conclusion.

SECTION 2

LITERATURE REVIEW

2.1 Review of The Literature

Historically, it was the conservative governments in the developed countries that first placed divestiture firmly on the policy agenda during the late 1970s. This policy stance, Bishop and Kay notwithstanding,³ was guided by at least three central considerations: 1) the conservative ideology and the central role it accorded the market, 2) perceived inefficiencies of public sectors enterprises (PSEs), and 3) large fiscal deficits--resulting, at least in part, from poor PSE financial performance and the demands they made on the Treasury.

³These two writers take the view that privatization, especially in Britain, was unplanned, that its objectives only evolved over time, and that it eventually came to be seen as an end in itself (see, Matthew Bishop and John Kay, Can Privatization Work?-Lessons From The UK, (London: London Business School, 1988).

But, as writers like Brittan and Marsh have argued, the embrace of the policy, especially in the United Kingdom, had a strong political motive: it was perceived as more popular and less traumatic to sell assets than to cut public expenditure.⁴

Across the developing countries, the 1960s and 1970s had witnessed a rapid growth in PSE. By the 1980s, these countries too were grappling with problems of poor PSE performance and chronic fiscal deficits. However, their problems were more intractable, compounded as they were by high domestic inflation, chronic external imbalances, large external debt over-hang, the resurgence of protectionism and a generally hostile external environment. Thus, whether by choice, or by duress - via structural adjustment conditionality - governments in the developing countries soon placed divestiture on the policy agenda.

For reasons of manageability and ease of exposition, this review is structured on the basis of the following sub-set of major issues dealt with in the literature on divestiture:⁵ 1) public versus private production and the role of efficiency and economic liberalization, 2) competition and regulation, 3) assets valuation, and 4) fiscal impact.

Even though the 1980s was characterized by pandemic dissatisfaction with the performance of PSEs, there is consensus in the literature that the problems of PSEs are not to be explained on the basis of any inherent inferiority of state ownership. Shirley, Van De Walle, Ramamurti, and numerous others, argue persuasively that the problems which PSEs face may have more to do with the manner in which owners elect to exercise the rights and privileges of ownership.⁶

⁴David Marsh, "Privatization Under Mrs. Thatcher: A Review of the Literature," Public Administration 69 (Winter 1991): 461.

⁵Admittedly, there is some amount of overlap between and among the issues as categorized here. But this does not pose a problem for the review.

⁶Mary Shirley, Managing State Owned Enterprises, World Bank Staff Paper 577 (1983): 17-54; Nicolas Van De Walle, "Privatization in Developing Countries: A Review of the Issues," World Development 17 (May 1989): pp. 601-602 and 610; Lawrence H. Wortzel, "Privatization: Not the Only Answer," World Development 17 (May 1989): pp. 636-638; Ravi Ramamurti, "Controlling State-Owned Enterprises," Public Enterprise 7 (March 1987), pp.- .

Indeed, this sentiment is to be found even in the views articulated by the World Bank, whose position on divestiture is not as straightforward as one might imagine. The available evidence suggests that the Bank is less concerned with ownership structure and more with issues of efficiency, liberalization, and competition.⁷

The following statement serves to support this conclusion:

. . . The key factor determining the efficiency of an enterprise is not whether it is publicly or privately owned, but how it is managed. In theory it is possible to create the kind of incentives that will maximize efficiency under any type of ownership. But there is a great difference between what is theoretically feasible and what typically happens.⁸

This helps to explain why, especially during the 1980s, the Bank was active in financing PSE restructuring in the developing countries.⁹ But the Bank apart, throughout the literature one finds that the preoccupation is with divestiture, liberalization, and competition, rather than with divestiture as an end in itself.

Writers emphasize fiscal gains as the central - though not the only - argument for divestiture in the developing

⁷See, C. S. Adams and W. P. Cavendish, "Can Privatization Succeed?: Economic Structure and Programme Design in Eight Commonwealth Countries," Development Studies Working Paper 34 (February 1991): 2-3; The World Bank, World Development Report, 1991 (Washington D. C.: The World Bank, 1991): pp. 139-157; Nellis and Kikeri, "Public Enterprise Reform," pp. 664-665.

⁸The World Bank, World Development Report, 1983 (Washington D.C.: World Bank, 1983), p. 50.

⁹It sees divestiture "not as an end in itself but as a means to an end: to use resources more efficiently" (The World Bank, World Development Report, 1991, p. 144).

countries.¹⁰ They identify two kinds of efficiency gains leading to these fiscal benefits: 1) gains in allocative efficiency, and 2) gains in cost, productive, or x-efficiency.¹¹

Arguing that allocative efficiency gains will depend on how well markets function (i.e. the extent to which relative output prices reflect relative scarcities in the economy), they conclude that the potential for such gains are generally modest,¹² but likely to be more significant if divestiture occurs in imperfectly competitive markets and is complemented by liberalization.¹³

The case for divestiture, then, is presented as resting more heavily on gains in productive efficiency within the divested firm, than on the broader issue of allocative efficiency. In other words, it rests on the extent to which private operators are forced to be more cost and service conscious than their public sector

¹⁰Other legitimate reasons for divestiture in LDCs are: raising revenues, encouraging foreign investment, curtailing power of public sector unions, building local capital market, rehabilitation and modernization of enterprises, access to technology and market entre (see, John Nellis and Sunita Kikeri, "Public Enterprise Reform: Privatization and the World bank," World Development 17 [May 1989], p. 665); Olivier Bouin, "Privatization in Developing Countries: Reflections on a Panacea," OECD Policy Brief 3 (1992), pp. 8-13.

¹¹Some writers include what is called gains from "non-market" efficiency. This concept suggests that "non-market failure after state intervention will be worst than the market failure the government set out to correct" (Nicolas Van De Walle, Privatization in Developing Countries: A Review of the Issues," World Development 17 [May 1989]: 605-606).

¹²This is neither a new nor novel position. Almost three decades ago Leibenstein, drawing attention to the importance of x-efficiency, demonstrated that ". . . microeconomic theory focuses on allocative efficiency to the exclusion of other types of efficiencies that, in fact, are much more significant in many instances" (Harvey Liebenstein, "Allocative vs. X-efficiency," American Economic Review, vol. LVI, p. 392).

¹³Richard Hemming and Ali M. Mansoor, "Is Privatization the Answer?" Finance & Development 25 (September 1988): 32; Nicolas Van De Walle, "Privatization in Developing Countries," pp. 604-605.

counterparts. However, most writers admit to the difficulty of ascertaining whether x-inefficiency is more a function of public ownership or protection from competition.¹⁴ Thus, in the literature, the issue of competition - especially where the divestiture is that of an imperfectly competitive or monopoly firm (as in the case of GTC) - and the role of regulation, come to assume inordinate importance.¹⁵

Competition rather than ownership is seen as holding the key to the realization of efficiency gains consequent upon divestiture.¹⁶

As one writer puts it,

The *prima facie* case for expecting an increase in efficiency as a result of privatization is strongest where *workable competition* exists.¹⁷

Also, there appears to be a tendency towards consensus that, to realize competitive outcomes, the incumbent firm must be: 1) prevented from extending its market power to areas which do not qualify for natural monopoly status, and 2) frustrated in any attempt to practice of cross-subsidization.¹⁸

To this end, divestiture of a monopoly operation, the literature advises, demands comprehensive regulation, lest the exercise of monopoly power frustrates the pursuit productive efficiency and the fiscal benefits which ought

¹⁴See, for example, Nicolas Van De Walle, "Privatization in Developing Countries," p. 605.

¹⁵John Vickers and George Yarrow, "Economic Perspectives on Privatization," Journal of Economic Perspective 5 (Spring 1991): 116.

¹⁶V. Bhaskar, "Privatization and the Developing Countries: The Issues and the Evidence," UNCTAD Discussion Paper 47 (August 1992): 2-9; Hemming and Mansoor, "Is Privatization the Answer?" p. 32; V. V. Ramanadham, gen. ed., Privatization in developing Countries (London: Routledge, 1989): Introducing Competition and Regulatory Requirements, by David Thompson, pp. 125-130.

¹⁷Raymond Vernon, "Conceptual Aspects of Privatization," CEPAL Review 37 (April 1989): 146.

¹⁸Matthew R. Bishop and John A. Kay, "Privatization in the United Kingdom: Lessons from Experience," World Development 17 (May 1989), p. 644.

to flow therefrom.¹⁹ It is pointed out, too, that granting a divested entity such concessions as tax exemptions, subsidies, investment credits, protection from liquidation, and access to soft credit defeat both the efficiency and fiscal objectives of divestiture.²⁰

Nowhere in the literature are the inordinate difficulties associated with the design and enforcement of regulation underplayed. Especially, writers emphasize the vast technical and other information required, the calibre and quantum of technical manpower needed, and the ever present threat of the capture of the regulatory body.²¹ The literature is less helpful on the issue of the valuation of assets. As one writer puts it,

Although there is a good deal of literature on the pricing of and valuation of company assets it tends not to be terribly informative in relation to . . . an economy without a capital market and in circumstances where the entity is a monopoly or near monopoly.²²

Generally, little information is provided beyond methods of valuation (e.g. net present value of expected earnings stream, asset value of an enterprise in liquidation,

¹⁹This is tantamount to saying that the purpose of regulation is to mimic the operations of the market, with a view to preventing a) prices being raised (above costs) to monopoly levels; b) the provision of sub-standard services; c) inefficient cost performance (See David Thompson, Introducing Competition and Regulatory Requirements, p. 125).

²⁰See, Elliot Berg and Mary Shirley, "Divestiture in Developing Countries," World Bank Discussion Paper 11 (Washington D.C.: The World Bank, 1990): p. 18; John Nellis and Sunita Kikeri, "Public Enterprise Reform: Privatization and the World Bank," World Development 17 (May 1989): pp. 669-670; Mary Shirley, "The Experience With Privatization," Finance & Development 25 (September 1988): p. 34.

²¹V. V. Ramanadham, gen. ed., Privatization in Developing Countries: Some Organizational Implications of Privatization, by Nick Woodward, pp. 133-141; Matthew R. Bishop and John Kay, "Privatization in the United Kingdom," p. 651.

²²Selwyn Ryan and Deryck Brown, gen. ed., Issues and Problems in Caribbean Public Administration (St. Augustine: Institute of Social and Economic Research, 1992): The Re-Privatization of Guyana, by Carl Greenidge, p. 293.

historical or replacement cost, leverage value). There is agreement that even when sale is effected via capital markets, controversy surrounds the price received. One wonders to what extent this limited treatment of the valuation and sale price issues in the literature might reflect the sentiment expressed by University of Harvard Professor of international Relations, Raymond Vernon, as follows:

There is one issue, however, to which governments have given far more attention than it may deserve. This is the question of determining the "right price" for specific offerings. In the [sic] most research on the price issue, the "right price" has usually been implicitly defined as the lowest possible price that the government could charge without exposing itself to the accusation of giving away public assets. Behind this implicit definition lies an ineluctable fact.²³

However, some of the writers associated with the Fund and Bank elaborate some useful general principles on the asset valuation. These principles might be captured (in an extremely collapsed form) as follows:²⁴ 1) asset transfers to the private sector, however effected, will always entail a transfer of wealth from government to that sector, and 2) the greater the degree of uncertainty associated with future profit streams and regulatory and tax regimes, the greater will be the transfer of wealth necessary to effect divestiture.

2.2 Assessment of The Literature

What comes out in the literature is that the divestiture debate is firmly rooted in neoclassical economic theory. Yet, it would be inaccurate to say that divestiture, indeed privatization, is presented as a theology. The literature presents balanced rather than dogmatic conclusions. In many instances there is no advocacy. Conclusions are tentative, essentially, it appears, because of the lack of empirical evidence, the difficulty of establishing causation, and a genuine

²³Raymond Vernon, "Conceptual Aspects of Privatization," CEPAL Review 37 (April 1989): 146.

²⁴Mario Blejer and Ke-Young Chu, Measurement of Fiscal Impact Methodological Issues, IMF Occasional Paper 59 (Washington, D.C.: IMF, 1988): The Budgetary Impact of Privatization by Ali M. Mansoor, pp. 49-52.

conviction that, contrary to what some politicians would have us believe, divestiture is no panacea.

The literature fails to persuade one of the efficacy of divestiture to promote significant improvements in efficiency and governments' budgetary position. Yet, it succeeds in convincing one - on the basis of the wealth of information on the poverty of public sector out-turn on which it draws - of the futility inherent in persisting with large public sectors, run as they have been in the past.

Perusal of the literature leaves one with a sentiment that was most eloquently articulated by John Maynard Keynes in the Sydney Ball Lecture at Oxford, almost seventy years ago:

. . . But above all, the ineptitude of public administrators strongly prejudiced the practical man in favour of *laissez-faire*--a sentiment which has by no means disappeared. Almost everything which the state did in the eighteenth century in excess of its minimum functions was, or seemed, injurious or unsuccessful.²⁵

It does seem that there remains quite a few areas in which further work needs to be undertaken. Thinking specifically of the Caribbean, it would appear to be useful to have future research focus on explanations and explorations of actual experiences with regulation, and the introduction of competition in industries which were previously monopolistic or oligopolistic. Also, it seems that an insightful Caribbean perspective on the process of divestiture in the region would demand that more comparative studies be undertaken.

²⁵John Maynard Keynes, The Collected Writings of John Maynard Keynes, vols. ix: Essays in Persuasion (London: Macmillan St. Martin's Press, 1931; reprint ed., London: Macmillan Press, 1972), p. 275.

SECTION 3METHODOLOGY3.1 Research Design3.1.1 Justification of Choice of Entity

This Research must be categorized as an explanatory and exploratory case study. Its concern is with the divestiture of GTC.²⁶ The choice of GTC's divestiture as the focus of the research is informed by the three principal considerations.

First, there could be little doubt that the GTC represents the largest and arguably the most strategic firm/industry divested to date. As such, both policy formulators and the academic community have a responsibility to learn as much as possible from this "experiment." Second, the Researcher, having worked in the Guyana Public Service during the time of the GTC divestiture, had reason to believe that the data and information required to effectively prosecute this study would be accessible. Third, even though it represents the divestiture of a relatively large and pivotal entity, no serious study has been done on the GTC divestiture. This research, then, could represent a useful contribution to Caribbean literature on divestiture.

3.1.2 Justification of Choice of Research Strategy

The literature on research design advises that the case study method is most applicable when the following conditions are fulfilled: 1) the research questions are structured on the basis of "how" and "why", 2) the study focuses on a contemporary event, and 3) there is no need for the researcher to have control over behavioral events. Also, it explains that one of the characteristics of exemplary case studies is significance of the case (in terms of public interest and theoretical and policy

²⁶Technically, we should speak of the divestiture of Guyana Telephone and Telegraph Company (GT&T) rather than that of GTC. Reason being that, to facilitate divestiture GTC had to be dissolved and GT&T--a fully government-owned private limited liability company--incorporated to assume all of GTC's assets and liabilities.

implications).²⁷ Based on these criteria there can be little doubt that this research enterprise lends itself to this research strategy.

3.1.3 Research Propositions

The propositions articulated here were instrumental in guiding the data/information collection process. They will also guide the analysis. These proposals were informed by the review of the literature and as such impose a theoretical framework on the analysis.²⁸

3.1.3.1 Research Propositions and their Theoretical basis

1) The design and enforcement of the regulatory regime represent one of the most limiting constraint to the garnering of greater revenues from the new entity;
2) appropriate legislation makes it possible to promote competition in the provision of telecommunication services in Guyana; 3) the valuation of GTC's assets ought to have been a relatively straightforward and non-controversy issue; 4) divesting the monopoly GTC will result in larger revenue flows to the Treasury and a substantial net improvement in the Treasury's financial position.

What all of these propositions have in common is that they are grounded in the theory. To demonstrate their theoretical content one need only present them as statements. Take proposition 1), for instance, this can be stated as follows: The case study will show why and how the design and enforcement of the regulatory regime can represent a constraint to the garnering of greater revenues from the divested entity.

Thus, the data collected are logically linked to the propositions and the analysis of the data will facilitate subscription to, or a questioning of, theories on divestiture gleaned from the literature.

3.1.4 Collecting the Evidence

The evidence on which this case study relies came from two principal sources, documentation and interviews. The former source comprised letters, memoranda, and facsimile

²⁷R.K. Yin, Case Study Research: Design and Methods, (California: Sage Publications, 1984; reprint ed., California: Sage Publications, 1991), pp. 17 & 146.

²⁸For a detailed discussion in support for this approach see, R. K. Yin, Case Study Research, pp. 29-30.

messages; minutes of meetings and written reports; project proposals; audited accounts; and newsclippings. The latter source comprised open-ended, elite-type interviews with senior bureaucrats and other individuals who were involved in the divestiture process. These interviews were useful in corroborating evidence found in the files and directing the researcher to other data sources.

3.1.5 General Analytical Strategy

The research propositions shall guide the analysis, impose selectivity in the data presented, and inform such alternative explanations as are merited. The sequence of the sections of the research shall be important in that each section will attempt to develop a strand of the argument of the research.

3.2 Techniques of Quantitative Manipulation

One of the limitations of this research is that the divested GT&T is merely 30 months old. To make the assessment of fiscal impact meaningful, a decision has been taken to project net resource flows to the Treasury for the period 1993-95 inclusive, and simulate a variety of scenarios based on different assumptions.

The exercise then becomes one of identifying the budgetary costs (outflows) and benefits (inflows) of divestiture to the budget, assigning them values, deflating the net value of the stream, and summing same to arrive at the net present worth (in 1990).²⁹

3.3 Problems Encountered and Limitations of the Research

The Researcher went into the field about four months after a change of government in Guyana. Many files and crucial documents could not be located; key actors in the divestiture process were no longer available for interviews. Obtaining an audience with all but one of the senior representatives of GT&T proved impossible. The chief executive officer of the Public Utilities Commission proved to be unhelpful, claiming that he has already been accused of leaking sensitive information.

Neither for GTC nor GT&T could detailed data be had. This is especially true of production cost data. As a result, projections of GT&T's performance proved to be impossible and this conditioned the most serious limitation of the research: the fiscal impact assessment is extremely

²⁹The discount factors for any year is equivalent to 1 plus the discount rate, raised to the power of time.

weak, dependent as it is on very general assumption about future resource flows.

Many of the more current writing on divestiture, indeed on privatization in general, proved impossible to find. For example, much work has been done on the fiscal impact of privatization, but most of these articles are to be found in the journal "fiscal Studies" which I have been unable to locate.

Lamentably, although I arranged for, and succeeded in having a third party collecting for me, a copy of GT&T's Accounts for the year ended 31 December, 1992, the document arrived too late to be used in the analysis.

SECTION 4

THE ENTITY GUYANA TELECOMMUNICATION CORPORATION

4.1 Situating The Divestiture

4.1.1 The Macroeconomic Reality in the 1980s

At the close of the 1970s Guyana had macroeconomic imbalances which, at least in the opinion of the Multilateral Financial Institutions (MFIs), were deemed chronic and unsustainable. These imbalances were being addressed via a structural adjustment programme, but soon thereafter Guyana went into arrears with the MFIs and became ineligible to draw on their resources. Thus, the decade of the 1980s found Guyana still with chronic and unsustainable macroeconomic imbalances but now, without recourse to the resources of the MFIs. No one could envisage at the time that it would take Guyana one decade to re-access the resources of these institutions.

In the interim, commendable efforts were made to effect adjustment without foreign savings, but to no avail. Not only did the imbalances persist but they became sufficiently intractable to allow one to speak of the existence of an economic crisis. The inadequacy of domestic savings and limited access to foreign savings³⁰

³⁰Throughout the period under consideration, Guyana's only major source of foreign savings was the IDB.

made proper economic management virtually impossible.³¹ The macroeconomic and financial performance indicators presented in Table 1 below attempt to capture the imbalances in the external, monetary, government and real sectors, during selected years for the period 1980-88.

The observed stagnation and eventual decline in real gross domestic product (GDP) (at factor cost) stemmed from severe setbacks experienced by the main pillars of the economy, bauxite and sugar (but especially the former). Real output contraction was reflected in poor export performance. The export volume index in 1987 was 30 percent below its 1980 level, having reached a nadir of 36 percent in 1983. Merchandise export receipts fell from US\$388.9 million in 1980 to US\$214 million in 1985, and (with the exception of 1987) continued to contract through 1988. Merchandise imports fell from US\$386.4 million in 1980 to US\$209.1 million in 1985, and continued contracting through 1988.

Notwithstanding the dismal production and export performance, central government current expenditures grew from 38.9 percent of GDP in 1980, to 67.2 percent in 1988. Thereafter, it remained well above its 1980 level. On the other hand, central government capital expenditures were virtually stagnant over this same period.

The overall public sector deficit almost doubled from 29 percent of GDP in 1980 to 57 percent in 1985. Thereafter it declined, but stood at 34.3 percent of GDP in 1988.

Inflation, whatever its source, was high. Whereas the official statistics show the consumer price index (CPI) in 1988 to be 94 percent above its 1985 base, the fact is that this represents an understatement of the reality.³² One

³¹It is a widely accepted view that effective macroeconomic management in most developing countries demands access to adequate foreign savings. For an articulation of this view see, for example, International Monetary Fund, "Theoretical Aspects of the Design of Fund-Supported Adjustment Programs," Occasional Paper 55 (September 1987): 42; Stephany Griffith-Jones and Osvaldo Sunkel, Debt and Development Crisis in Latin America: The End of an Illusion (Oxford: Clarendon Press, 1986; reprint ed., Oxford, Great Britain: by David Stanford, 1989), p. 34.

³²The index did not capture prices in the pandemic parallel market. Also, its used consumption patterns from 1969-70. For these and other reasons, official computation of the CPI ceased in July, 1989.

factor contributing to inflationary pressures might have been the rate of growth of money and that of domestic credit - particularly to the public sector - required to finance the fiscal deficit.

TABLE 1

GUYANA: SELECTED ECONOMIC AND FINANCIAL INDICATORS
(Annual Percentage Change Unless Otherwise Stated)

	1980	1985	1987	1988
Real GDP (at factor cost)	2.4	2.4	0.9	-2.6
CPI (1985=100)	7.7	...	138.9	194.4
Merchandise Exports (fob)	32.9	-1.3	14.5	-10.7
Export Vol. Index:1980=100	...	75.0	70.0	...
Merchandise Imports (fob)	33.8	1.7	0.9	-17.1
Claims on Public Sector	38.21	36.2	30.2	60.1
Money	3.8	19.6	81.3	57.2
<u>PUBLIC FINANCES</u>				
(as % of GDP)				
Central Govt. Curr. Exp.	39.8	75.1	70.3	67.2
Central Govt. Cap Exp.	12.2	18.3	15.0	10.2
Public Sector Overall Def.		56.9	35.1	34.3
<u>EXTERNAL SECTOR</u>				
(as % of M'dise exports)				
Current Account Deficit	...	61.3	54.1	43.6
Debt Service	...	80.5	96.7	109.8

Source: International Monetary Fund, International Financial Statistics, May 1992, Vol. XLV (Washington D.C.: International Monetary Fund Publication Services, 1992^h, pp. 262-265; International Bank for Reconstruction and Development, Guyana: Policy Framework Paper, 1990-92, prepared by the Government of Guyana, June 21, 1990.

As one would expect in a situation of poor export performance and high inflation,³³ the external accounts deteriorated. For instance, the current account deficit, which stood at 67 percent of merchandise exports in 1986, was unsustainably high. Also, the debt service burden was extremely limiting. These two facts suggest: 1) that external payment arrears were accumulating and 2) the net outflow (transfer) of investible resources must have been substantial.

In fact, arrears on suppliers credit reached the point where creditors demanded payment prior to the shipment of commodities. The purchase of petroleum and petroleum products, for instance, depended on government's convertible currency cash flow from month to month. On numerous occasions, the economy, literally, threatened to grind to a halt for want of these and other intermediate inputs.

4.1.2 Implications for Telecommunications

The fiscal imbalance meant that the government was strapped for cash (for reasons that had nothing to do with the telecommunication corporation since it was not a drain on the budget). The external imbalance meant there was a chronic and acute shortage of convertible currency. These two realities posed problems for public sector management. The public utilities (and the social sector) suffered most. The Finance Ministry pruned (primarily) their capital budgets; the Central Bank (whose rationality guided the allocation of convertible currency), accorded the productive sectors precedence in the allocation of these scarce resources.

Consequently, public utilities reached such a state of disrepair that national life and economic activity were continuously disrupted. Indeed, when one considers the extent to which both economic and social well-being depend on quality of the services provided by the utilities (electricity and potable water supply, telecommunications services, water transport, sea defenses), one is hard put to identify a more critical structural bottleneck.

³³At least one who is persuaded of the analytical usefulness of the "monetary approach to the balance of payments" for policy formulation in small, open, developing countries.

Given the openness of the economy,³⁴ import contraction (and the shortage of convertible currency) had serious implications for the availability of intermediate inputs and capital goods and, consequently, the level of utilization of installed capacities fell throughout the economy. For instance, we are told that, for the period 1983-85, capacity utilization in the public corporations averaged 35 percent, and that in many of the utilities it was as low as 20 percent.³⁵

Among the utilities telecommunications is unique: in addition to saving and facilitating the earning of convertible currency, it is also an earner of foreign exchange. But government's approach to this sub-sector did not reflect a recognition of this fact. This is the reality in many developing countries.

Saunders, Warford, and Wellenius, in their seminal work on the telecommunications sub-sector, illustrates this using cases from South Asia and East Africa. They show that, even where foreign exchange had already been secured and governments' local currency contribution amounted to less than US\$2 million (which would have been quickly recouped many times over),

The governments, however, were financially strapped for macroeconomic reasons unrelated to the telecommunications sector, and the small amount of money in local currency was not forthcoming.³⁶

So GTC's experience conforms to a known pattern: in times of fiscal and external deficits, telecommunications investments, not being as lumpy

. . . as dams, airports, or power stations, . . . can be cut back piece by piece--fewer subscribers connected, fewer towns served, less long-distance capacity in the short-run--without totally stopping the effectiveness of much of the investment already completed. Hence, the sector is more amenable than many to last-minute

³⁴As measured, say, by the high import content in both consumption and investment.

³⁵Carl Greenidge, The Re-Privatization of Guyana, p. 281.

³⁶Robert J. Saunders, Jeremy J. Warford, and Bjorn Wellenius, Telecommunications and Economic Development (Baltimore: John Hopkins University Press, 1983): p. 237.

unplanned cuts in its investment programme brought about by exogenous national fiscal problems.³⁷

4.1.3 A New Vision for the Sector

Government's view of the telecommunications sector (indeed its view of the entire economic infrastructure) changed, of necessity, after Guyana managed to clear its arrears with the MFI and entered IMF and IBRD Programmes in 1989.³⁸ Government articulated a recognition of the pivotal role to be played by foreign private capital in facilitating the economy's accessing financial, technological, managerial resources. However, government recognized that the infrastructure rehabilitation and expansion were critical to attracting foreign investors.

These entrepreneurs will not invest in Guyana if it means being cut off from headquarters and the rest of the world. Indeed, these investors demand a reasonably modern telecommunications system which provides modern services. One harsh reality to be accepted was that, unlike poor electricity and potable water supply, poor telecommunication services, cannot be circumvented by resort to personalized and standby facilities.

This is the context in which the import and urgency attached by the Government of Guyana (GOG) to the rehabilitation, expansion, and modernization of the national telecommunication network needs to be seen.

4.2 The Need for Definitional Specificity

It is neither possible nor desirable to keep the concept **efficiency** out of a discussion on divestiture. "An efficient technique is a way of doing things that is not clearly more wasteful than alternative techniques,"³⁹ always, given the structure of relative prices in the

³⁷Ibid., p. 67.

³⁸Guyana's Policy Framework Paper lists infrastructural bottlenecks as one of the country's most limiting constraint, posits the view that a full solution can only be envisaged over the medium- to long-term, and sets (as one of the principal objectives of the Fund Programme) rehabilitation of both economic and social infrastructure.

³⁹John Cody, Helen Hughes, and David Wall, gen. eds., Policies for Industrial Progress in Developing Countries (New York: Oxford University Press, 1980): Labour and Technology by Amartya Sen, p. 122.

particular situation. For sake of definiteness, therefore, the following concepts of efficiency are defined.

Allocative Inefficiency is defined as the production of output in a less than socially optimal manner (i.e at above minimum social cost). In other words, allocative efficiency requires that the market price of inputs be equivalent to their social cost, so that the objective of profit maximization would result in both the socially appropriate input mix and the minimization of private cost of production.

To promote allocative efficiency in operating a monopoly utility like telecommunications, traditional welfare economics suggests that "price should be set equal to the incremental or marginal cost of expanding output"⁴⁰ if there is under-utilization of capacity. An important point to keep in mind is that allocative efficiency presupposes a high degree of productive efficiency.

Cost, Production, or X-Inefficiency is defined as the existence of "slack" due to wastage and/or managerial incompetence. In other words, if one focuses on a monopoly operation, for instance, then, so long as the operator has no control over factor markets, profit maximization necessitates cost minimization.

Equipment and Network Inefficiency is used to focus on the inflation of production costs occasioned by the extent to which the network has fallen behind the prevailing state of the art, and inadequate maintenance. This type of inefficiency, a sub-set of x-efficiency, is readily captured by the technical indicators of the network.

This concept **effective service** is defined from the perspective of the consumer. The "user pays for speed, availability, universality, reliability and a defined quality of service."⁴¹ The fewer of these criteria the network satisfies, the more ineffective is the service it provides.

⁴⁰Saunders, Warford, and Wellenius, Telecommunications and Economic Development, p. 237

⁴¹"Telecommunications and Socio-Economic Development," The Courier 77 (January-February 1983): p. 58.

4.3 Evolution of GTC

4.3.1 Technology and Efficiency

GTC, a fully government-owned public corporation was created by the Public Corporation Order No. 11 of 1967 and continued under the Public Corporations Act of 1980. The Corporation's objectives were to: 1) promote economic development of telecommunications infrastructure and services, 2) satisfy public demand for telecommunication services, and 3) universalize telecommunication services.

From 1980, the international, local distribution, and telegraph systems were merged. Thus, for 10 years--from 1980 until its divestiture in 1991--GTC was solely responsible for all telephone, telex, and international telegraph services and the provision of all the national telecommunications infrastructure.

By 1988, GTC operated 24 exchanges, an earth station for satellite communications, a tropospheric scatter link, micro-wave links, and a maritime coastal station. The national network comprised three different types of plant: 1) subscriber apparatus, 2) transmission and switching equipment, and 3) outside plant (between subscribers and exchanges and between exchanges).

There were 24 exchanges (linked by microwave sets), with facilities for subscriber trunk dialling. The tropospheric scatter system linked the country with the Eastern Caribbean Microwave System. The earth station linked with the Intelsat Atlantic Ocean Satellite system, facilitating direct communication with North America and the United Kingdom. There were two voice graded circuits for communication with Brazil, and Suriname and Nickerie were accessible via microwave.

At the time of divestiture the international network service consisted of 117 voice graded circuits, 60 percent of which were devoted to the major traffic streams (the USA, Canada, and the UK). The destination distribution of these circuits is shown in Table 2 below. Well behind the "cutting edge" of telecommunications technology, the switching system comprised old and obsolete electro-mechanical and semi-electronic analog equipment. GTC's most significant investments in improved facilities over the years were the installation of a Standard "B" earth station, and the rehabilitation and expansion of the tropospheric scatter system.

TABLE 2

**DISTRIBUTION OF INTERNATIONAL CIRCUITS
AND THEIR ASSOCIATED MEDIA, 1988-90**

CIRCUITS	EARTH STATION	TROPO- SCATTER	MICRO- WAVE	TOTAL
GUYANA - U.S.A.	27	26	...	53
GUYANA - U.K	10	...	...	10
GUYANA - CANADA	07	...	...	07
GUYANA - BRAZIL	02	...	...	02
GUYANA - T & T	...	25	...	25
GUYANA - BARBADOS	...	11	...	11
GUYANA - ANTIGUA	...	03	...	03
GUYANA - SURINAME	...	...	03	03
GUYANA - NICKERIE	...	...	03	03
TOTAL	46	65	06	117

Source: Guyana Telecommunication Corporation, Northern Telecom Project Proposal: Technical Study (Georgetown: Guyana Telecommunication Corporation, 1988): p. 68.

The international network constituted an area of serious concern. At least two issues merit elaboration. First, circuit saturation was the norm. The (incoming) call completion rate hovered consistently around 20 percent, a clear indication of the dire need to at least double the circuits. Second, in an environment in which incoming and outgoing calls enjoyed equal access to international channels, GTC's manual operation meant that outgoing calls were less likely to get through than incoming calls. This explains, at least partially, the high ratio of incoming to outgoing calls (approximately 3:1).⁴²

There appears to have been members of GTC's Management Team who were myopic enough to use this ratio to somehow rationalize the Corporation's failure to adequately expand

⁴²Of course, if earning revenues were the only reason for operating the national network, such a situation would not be without its benefits. Consider, for instance, the extreme case in which only incoming calls are facilitated. Outpayment would always be zero.

and modernize the public network. The quotation below supports the accuracy observation:

With an investment of about US\$3 million, Guyana could install automatic equipment. This would reduce its payments per outgoing call to an amount equal to receipts per incoming call. Based on GTC's expectations, this savings would be offset by a rise in the ratio of outgoing to incoming calls, so that such an investment would produce no net foreign exchange.⁴³

GTC's principal switching problems were associated with the mixed technology of the exchanges; failure to effect routine maintenance because of foreign exchange, cost, and procurement difficulties; battery failure; and the inability to perform standard prescribed routines.⁴⁴ The gravity of the problems could be gleaned from the fact that by GTC's own admission, in 1988, exchange-related faults alone accounted for 38 and 10 percent of the down time at the Earth Station and Tropospheric Scatter system, respectively.

The national network had an installed capacity of 28,000 lines but its recorded subscriber base always hovered around 21,000. In 1990, in-service access lines were down to 17,000 or 61 percent utilization of installed capacity. It was not unusual to find, at any one time, 20 percent of all telephones out of service - the norm for out of service telephones in an efficient network is less than one percent.⁴⁵ Throughout the 1980s and up to the time of divestiture, Guyana's telephone density was, at most, 2.2 lines in service per 100 inhabitants, as compared with countries like Trinidad and Tobago where the density was closer to 6 lines. Employees per 1000 direct exchange lines in service, a rough indicator of productivity, stood

⁴³Finding of Consultant recruited to review the operations of PSEs, as recorded in "Report on Performance of public Sector Corporations," presented to State Planning Secretariat in 1988 (mimeographed).

⁴⁴Guyana Telecommunication Corporation, Northern Telecom Project Proposal: Technical Study, (Georgetown: Guyana Telecommunication Communication, 1988): pp. 5-6.

⁴⁵Denise Dawn de Souza, "Notes of Wrap-Up Meeting With Representatives of Atlantic Tele-Network, Held on 31 August, 1989," State Planning Secretariat files.

at 57 in 1988. Indeed, the view was expressed that GTC was usually about 40 percent over staffed.⁴⁶

There was a large but unquantified demand for telephone services. In 1989, outstanding applicants, a poor surrogate for unmet demand, stood at some 20,000: the equivalent of 77 percent of installed capacity and 95 percent of registered subscribers.⁴⁷ Persons waited as many as 10 years for a line and efforts to circumvent the queue led to corruption.

Any pretense of providing a universal service had long ceased. At the time of divestiture, whereas the three main population centers (Georgetown, New Amsterdam, and Linden) constituted 85 percent of GTC's subscriber base, Georgetown alone accounted for 71 percent of all lines in service.⁴⁸ That this de facto urban bias could only increase over time is borne out by the following statement:

It is important to note that the "Urban Pull" is implemented whereby the most cost effect [sic] area is first improved so as to create further revenues for improvement in the other areas.⁴⁹

Doubtless, this logic applied also to routine maintenance and fault correction.

The external plant was plagued by a high rate of re-occurring faults, deteriorated main cables and cabinets, and manual testing of faults. Data for 1987 show that in that year:⁵⁰ 1) there were some 230 faults reported per

⁴⁶Denise Dawn de Souza, interview held at State Planning Secretariat, South Road, Georgetown, March 1993.

⁴⁷"Experience in other developing countries indicate that when . . . there are acute shortages, the number of registered outstanding applications greatly under-estimate unmet total demand" (The World Bank, People's Republic of China Telephone Sector Study: Survey, Assessment and Strategy Recommendations [Washington D.C.: The World Bank, 1992]: p. 10.)

⁴⁸Eustace Abrams, interview held at his office, Brickdam, Georgetown, Guyana, March 1993.

⁴⁹Deputy Prime Minister (with responsibility for Public Utilities), "Memorandum to Cabinet on Northern Telecom Project," 30 August, 1988.

⁵⁰Guyana Telecommunication Corporation, Northern Telecom Project Proposal, pp. 5-16.

week - some 42 percent of which were in the business sector - and 2) it took about twenty man-hours, on average, to clear a fault (i.e. about two days using a two-man crew).

4.3.2 Financial Performance⁵¹

Contrary to what one might expect, given the myriad and daunting problems with which GTC was beset, the corporation was always profitable. It was the only public utility that needed neither current nor capital transfer from the Treasury. Indeed, GTC's transfers to the Treasury - corporate tax, company income tax, property tax, and dividends - were always positive.⁵² This can be seen in Table 3 below. Table 4 provides data on some key financial indicators of performance.

Profitability: Over the period 1987-90, mean profits before taxes were G\$111.4 million while mean net profits was about G\$56.3 million. The profits to sales ratio averaged 12.5 percent (see table 4 below). Fixed assets increased from G\$83 million in 1987 to G\$556 million in 1990.

Financial Stability: Retained earnings more than doubled from G\$86 million in 1987 to G\$187.2 in 1990. Capital employed increased from G\$77.5 million in 1985 to G\$1360 million in 1990. The ability of the Corporation to meet its immediate and future liabilities was satisfactory, as can be seen from the ratio of current assets to current liabilities.

Rate of Return: The average rate of return (before taxes) on net fixed assets was an impressive 64.8 percent,

⁵¹The many qualifications in GTC's audited accounts, as well as interviews with the public sector officers responsible for monitoring GTC's performance, indicate that one ought not to place too much faith in these accounts. Nevertheless, some conventional financial indicators shall be presented. But, the reader is cautioned not to place too much weight on these indicators.

⁵²Equally important, GTC always had a positive net foreign exchange cash flow in its transactions with foreign telecommunication administrations. In 1988, the net position was US\$5.36 million; in 1990, it was US\$9.6 million. So the Central Bank was guaranteed a reliable flow of convertible currencies from GTC's operations. However, GTC had no control over these funds once they entered the Central Bank.

and the mean rate of return (before taxes) on capital employed was around 40.3 percent (see Table 4 below).⁵³

TABLE 3

**SUMMARY FINANCIAL STATEMENTS FOR GTC
1987-90**

G\$million

STATEMENT SUMMARIES	1987	1988	1989	1990
Profit Before Taxes	12.1	105.0	117.6	363.0
Net Profits	5.6	49.4	29.2	197.5
Retained Earnings	85.9	125.2	24.7	187.2
Total Capital Employed	100.9	140.3	243.0	1360.0
Fixed Assets	82.9	68.8	282.5	555.6
Current Assets	240.8	323.5	407.9	804.8
Current Liabilities	222.8	251.9	447.4	672.2
Net Current Assets	18.0	71.5	-39.6	132.6
Taxes Paid	6.4	55.7	63.1	164.5
Dividends Paid	...	10.0	54.5	35.0
Total Transfers	6.4	65.7	107.6	199.5

Source: Financial Statements of the Auditors on Guyana Telecommunication Corporation, 1987-90.

TABLE 4

**INDICATORS OF GTC'S FINANCIAL PERFORMANCE
1987-90**

INDICATOR	1987	1988	1989	1990
ROR on Net Fixed Assets	15%	152%	42%	65%
ROR on Capital Employed	12%	75%	48%	27%
Net Profits / Sales		18.7%	8.3%	19.8%
Current Assets/Current Liabilities	1.1:1	1.3:1	.91:1	1.2:1

Source: Computed using GTC's Financial Statements.

⁵³World Bank-financed projects are usually expected to yield an R.O.R. of between 12 and 16 percent.

Investment: The lack of sufficiently disaggregated accounts makes it impossible to compare the performance of individual service components. Especially, it makes impossible a comparison of the local and international operations.

Official documents cite **approved** capital investment for the years 1986, 1987, and 1988 as G\$11.0 million, G\$28.0 million, and G\$14.4 million, respectively (on average, some US\$2.2 million per year over the period). The **actual** investment was in fact less.⁵⁴

GTC's Finance and Operating Statements show capital expenditures of G\$296.2 million for 1990 (or US\$6.6 million at an exchange rate of G\$45 = US\$1). This is the highest absolute level of capital expenditures incurred over the period 1984-90. Indeed, it represented some 5 percent of GNP, well above the 0.5 percent average for developing countries.⁵⁵

4.3.3 The Role And Structure of Tariffs

Between 1985 and April 1989, the value of the Guyana Dollar moved from G\$4.4 to US\$1, to G\$33 to US\$1, a nominal devaluation of some 86 percent. Over the same period (and using 1985 as the base year) the CPI increased by 94.4 percent.⁵⁶ Yet, for that entire period, tariffs remained unchanged. Further, although GTC's apportionment of total operating and administrative cost between the local and international networks was given as 70:30,⁵⁷ revenue from international operations accounted for some 60 percent of

⁵⁴The official G\$/US\$ exchange parity in 1986, 1987, and 1988 was 4.4/1, 10/1, and 10/1, respectively. The actual investment expenditures were G\$2.2 million, G\$22.3 million, and G\$2.0 million, respectively.

⁵⁵Capital expenditure is used here as a surrogate for investment, an approach which could hardly be deemed controversial. The International Financial Statistics gives Guyana's GNP in 1990 as to G\$20,219 million or US\$449 million.

⁵⁶International Monetary Fund, International Financial Statistics, (Washington: International Monetary Fund, 1992): p. 248-251.

Note: The observation made earlier (see sub-section 4.1.1 footnote 32) about how misleading the CPI was during this period ought to be kept in mind.

⁵⁷This is not surprising. In all telephone systems most of the cost per subscriber arises in the local network.

total revenue. In other words, local call charges failed to keep pace with the costs associated with local calls.

Revenue expansion was also frustrated by the fact that international collection charges lagged well behind what they should have been. In 1988, for instance, GTC pointed out to the GOG that collection charges on the major traffic streams were, on average, 40 percent below that required to cover operating costs plus outpayment. What is more, these collection charges were shown to be well below those for counterpart countries over the same routes.⁵⁸ Such a situation, by violating the dollar parity consideration, encouraged more outgoing calls than would otherwise have been made and, consequently, forced up outpayment and undermined earnings.⁵⁹

4.4 Discussion to Section 4

All the indicators examined tell the same story: GTC provided an inefficient and ineffective service. In a world in which telecommunication had become critical to the survival and growth of large and small firms alike, and indispensable to the exploitation of new avenues of comparative advantage; a world in which

Telecommunications is currently the subject of rapid and unpredictable technical advances, . . . Guyana's system was almost a full two generations behind state-of-the-art technology.⁶⁰

The deterioration of the national network took place over a period of two decades. Yet, for most of this period the GOG appeared to be ignoring the unfolding reality. The owners and operators of GTC were eventually prompted to act in 1988 because of increased agitation by the business community. Their response was the so-called Northern Telecom Project: a relatively modest undertaking begun in 1989, with the objectives of improving the international

⁵⁸Guyana Telecommunication Corporation, "Application for Rate Increases," Georgetown, 1988 (Mimeographed).

⁵⁹Basically, violating the dollar parity facilitates capital flight by domestic agents.

⁶⁰The Re-Privatization of Guyana, by Carl Greenidge, pp. 279-303.

network and rehabilitating the Georgetown exchange.⁶¹

Both the owners and operators of GTC seemed satisfied that the Corporation was financially viable. But what of the ineffectiveness of its service? What of GTC's cost inefficiency? What of the cost inefficiency that GTC's service - or the lack thereof - imposed on the rest of the economy?⁶²

Impressive financial surpluses in the face of cost and network inefficiencies is neither an economic nor financial conundrum. The following observation not only resolves the apparent contradiction but captures the Guyana scenario quite well:

Since, in excess-demand situations, even badly managed telecommunications organizations can be highly profitable in a financial sense, management of monopoly telecommunications entities in developing countries have in some instances been less than cost or service conscious.⁶³

It appears to be beyond dispute that both GTC's network inefficiency and x-inefficiency can be traced to underinvestment. X-efficiency in the corporation was frustrated by, among other things, technical and organizational diseconomies: obsolescence, inadequate and untimely maintenance, over staffing, high staff turn-over, insufficient training, and lack of financial and management autonomy.⁶⁴

Looked at from this perspective, it seems reasonable to argue that the financial surpluses generated by GTC were illusory: "paper profits," insufficient to pay taxes and

⁶¹The project was financed by Supplier's Credit to the tune of US\$7.5 million from Northern Telecom International Finance (NTIF).

⁶²Some examples of the latter are the value of time wasted in call attempts, foreign exchange losses through poor call completion rates, the value of time spent to reach a telephone, and overall higher operating costs.

⁶³Saunders, Warford, and Wellenius, Telecommunications and Economic Development, p. 61.

⁶⁴From 1978 and 1988, GTC changed 6 General Managers, 3 Financial Controllers, and 3 Administrative Officers.

realistic dividends,⁶⁵ and finance a sufficient proportion of investment (i.e investment oriented towards routine maintenance, rehabilitation, expansion and modernization of the network).⁶⁶ In other words, these surpluses would never have sufficed to expand and modernize the system, with a view to overcoming the inefficiencies which inhered in the network as operated.⁶⁷

The tariff structure, as well as the bureaucratic mechanism for effecting adjustments, was certainly a contributing factors. Telecommunications economics theory suggests that tariff setting be informed by the need to cover operating expenses, interest on capital employed, fiscal charges, depreciation, research and development, and capital investment as required. Further, elementary economics teaches that in an environment of persistently high inflation, unless tariffs are adjusted in a timely manner, their real value, and consequently government's revenue intake, will be undermined. Neither principle was observed in the setting of GTC's tariffs.

Another contributing factor was Government's control of GTC's surpluses, capital programme, and budgets. Given the relatively high capital/output and incremental capital/output ratios of telecommunications industries, and given the high import content of telecommunications investment, both fiscal austerity and balance of payments difficulties conditioned under-investment.

The fact of the matter is that a monopoly telecommunications entity, like GTC, can easily do better than simply maintain financial viability. It seems axiomatic that in the short-run, the price elasticity of demand for telecommunication services is inelastic. If one accepts this premise - and takes cognizance of both the long waiting list for service and the chronic circuit congestion - there are very cogent arguments for deriving tariffs on a forward-looking rather than a historical cost

⁶⁵By realistic dividends is meant levels that would be required if investible funds had to be attracted.

⁶⁶Observe that for World Bank-financed projects, for example, internal cash generation typically funds 50 percent of capital investment.

⁶⁷Accountants describe this phenomenon as "**under-capitalization**," meaning that the firm's asset base is too small for its level of operation. Heavy reliance on suppliers' credit to undertake expansion, equipment purchase, and upgrading is a manifestation of this phenomenon.

basis.⁶⁸

The adoption of such an approach would have dictated relatively high connection and rental fees and high peak period collection charges. Its advantages include a less corrupt-prone form of rationing, allowing consumer demand to suggest which service components should be expanded, and, certainly, more buoyant revenues and fiscal flows.⁶⁹ But the adoption of this approach would have required that the GOG allow the entity greater financial, managerial, and technical autonomy. Especially, the GOG would have had to allow GTC the latitude to set fees and tariff levels for its various service components (possibly within government-set parameters).

SECTION 5

DIVESTITURE: THE TRANSFER OF GTC'S ASSETS

5.1 The Objectives Of GTC's Divestiture

As early as March 1988, government articulated the following position:

. . . The conduct of business . . . is crucially dependent on the prompt and efficient flow of information. In turn, the various systems for facilitating this flow have been subject, and will continue to be subject to a rapid advance in technology. We therefore seek investment in the technically efficient, cost-effective provision of this service, in terms of both the hardware and software required, and appropriate maintenance and management systems.⁷⁰

⁶⁸Forward-looking pricing presupposes an attempt to estimate marginal cost. Admittedly, this exercise poses difficulties associated with demand forecasting, income distribution, declining unit costs, and externalities. But, these problems apart, this approach would serve to enhance allocative efficiency.

⁶⁹See Saunders, Warford, and Wellenius, Telecommunications and Economic Development, pp. 236-250.

⁷⁰Government of Guyana, State Paper: The Guyana Investment Policy, (Georgetown: State Planning Secretariat, 1988): p. 36.

These sentiments reflected, among other things, concern about the low capacity utilization in the utilities--hovering around a mere 20 percent ever since 1983. According to the then Minister of Finance, this failure of the utilities to deliver the goods and "services for which they were established," turned out to be a major government argument for privatization.⁷¹

Not surprisingly, therefore, the objectives of GTC's divestiture were formulated in terms of the modernization and rehabilitation of its service equipment, with the ultimate goal of providing better quality services to the public.⁷²

5.2 The Issues of Valuation and Sale Price

The GOG's search for a foreign equity partner in the GTC began in early 1987. Between 2-9 September, 1988 teams from Cable & Wireless and British Telecom studied GTC's operations.⁷³ Their conclusions were that: 1) the network needed to be replaced with a digital, catering for about 60,000 subscribers within five years, at a cost of some US\$100-120 million, 2) upgrading the network (via the Northern Telecom Project) without a long-term plan could prove costly, and could scare off potential investors, 3) the tariff structure relied too heavily on international revenues and needed drastic changes, and 4) with the political will to accept foreign majority holding, modernize the tariff structure, and allow the operator first call on international revenues, Guyana stood a good chance of attracting a company capable of modernizing the network.

There was no queue of reputable potential foreign investors awaiting an opportunity to invest in GTC. As government's Financial Advisers explained,

⁷¹The Re-Privatization of Guyana, by Carl B. Greenidge, p. 281.

⁷²Government of Guyana, "Divestiture Policy Document," (Georgetown: State Planning Secretariat, 1988): p. 36 (mimeographed).

⁷³See, P.L. Skey, Report on Visit to Guyana to Assess the Requirements and Potential of the Telephone System, presented to State Planning Secretariat, December, 1988; and Paul Lesseells, Report on British Telecom Study Team Visit to Guyana, presented to State Planning Secretariat, December 1988.

GTC is in direct competition for investors...with several other telecommunications networks throughout Central and South America and the Caribbean and since GTC has been so short of investment, most other networks are more attractive commercial prospects.⁷⁴

Indeed, ATN, the multinational corporation with whom an agreement was eventually reached, was selected essentially by default, after other indications of interest were withdrawn.

In the absence of a capital market or the likelihood of competitive bidding, sale had to be based on negotiations. Contrary to what its critics would have preferred, government commissioned no independent valuation of GTC's assets. Nor did the GOG commission any work on the revenue and economic implications of different modalities of sale, terms, and conditions.

The GOG saw itself as having two options: 1) go for the largest possible cash payment, with which would be associated a delay in the mounting of an investment programme, or 2) accept a significantly lower price, retain some equity, and demand an immediate, realistic, rehabilitation and expansion programme. The latter option was deemed preferred.

When the GOG and ATN finally concluded negotiations, it was agreed that ATN would: 1) make a cash payment of US\$16.5 million⁷⁵ 2) mount an investment programme worth US\$80 million over a 3-year period, and 3) assume liabilities totalling US\$10.5 million. As has happened elsewhere, valuation and final price issues loomed large (and continue so to do) in the GTC divestiture debate.

5.2.1 Resolving the Valuation Controversy: An Appeal to Theory

Economic theory posits that the sale of an asset is a capital account transaction with implications similar to those of the sale of a bond. If a public sector enterprise is sold to a private investor at a competitive price, this price must correspond closely to the discounted stream of

⁷⁴M.E. Adda, "GTC," Facsimile message to Deputy Prime Minister (Planning and Development), (dated 27 February, 1990): p. 2.

⁷⁵The value of 16,500 shares at US\$1,000 each. The GOG paid US\$4.125 for 20 percent. Which makes the total selling price US\$20.625 million.

its after-tax profits. Assuming perfect foresight - in which case the discount rate implicit in the transaction reflects correctly financial opportunity costs - the sale amounts to nothing more than an exchange of assets and liabilities between the two sectors.

But, perfect foresight is not possible, so private investors are risk-averse: what they are prepared to pay for an asset is based on the degree of uncertainty attached to its future income streams.⁷⁶ Thus, the disposal of the disposal assets can be effected only at a discount relative to their competitive price. This holds true whatever the method of asset disposal. Clearly then, when governments negotiate with a single investor, the differential between competitive and received price must be even greater.⁷⁷ For some unknown reason, critics appear to have studiously ignored these facts.

The foregoing ought not to be construed to mean that some idea of the value of assets to be disposed of is unimportant. In negotiations every bit of information is vital. But critics of the GOG approach were right for all the wrong reasons. It is true that the closer the sale price is to what is deemed to be the competitive value of the assets in question the less are the transfers being made to the private sector. However, a high price ought not to be made an end in itself. As has been argued by Vernon,

If the objective of governments in privatization were simply to maximize social output, they might well be justified in giving away many state-owned enterprises and even subsidizing their transfer.⁷⁸

⁷⁶Indeed, this discount is greater the more the private investor's uncertainty about the future profits, tax regime, labour relations, regulatory regime, etc. Also, governments, while anxious to sell are ignorant of the investor's reservation price.

⁷⁷Mario Blejer and Ke-Young Chu, Measurement of Fiscal Impact Methodological Issues, IMF Occasional Paper 59 (Washington, D.C.: IMF, 1988); The Budgetary Impact of Privatization by Ali M. Mansoor, pp. 49-52; Olivier Bouin, Privatization in Developing Countries: Reflections on a Panacea, OECD Development Centre, Policy Brief No. 3 (OECD: 1992), pp.12-19.

⁷⁸Raymond Vernon, "Conceptual Aspects of Privatization," CEPAL Review 37 (April 1989): 147.

This point can be made even more forcefully. For example, Mansoor argued that,

. . . it is largely irrelevant whether the government captures the benefits of a larger income stream through an up-front payment in the sales price or through an improvement in future tax revenue.⁷⁹

In other words, insofar as government was committed to divestiture, the imperative becomes: how best to ensure improved performance on the part of the new enterprise and thereby augment financial flows to the Treasury.

It needs to be said, too, that it is highly probable that controversy would have surrounded whatever valuation were arrived at by an independent expert. Reason being that GTC's accounts were extremely untidy and inaccurate. I have been able to find only one participant in the GTC divestiture process who appeared to have understood the constraint imposed by the state of GTC's accounts. He wrote thus:

In terms of the matter of price, I received recently the 1988 audited accounts of GTC . . . May I draw your attention to the five qualifications listed. I am almost sure that similar qualifications were attached to previous reports. In the circumstances there has been a difficulty in using the accounts as a basis for some of the selling price estimating techniques which we touched on during our discussion last night.⁸⁰

I have verified that all of GTC's audited accounts for the period 1985-88, inclusive, are qualified. The qualifications deal with such issues as the inability to reconcile GTC's accounts with overseas telecommunications administrations, and to verify the existence and value of components of fixed assets, and end with the statement,

because of the significance of the matters referred to in the preceding paragraphs, we are unable to form an opinion as to whether the

⁷⁹Ali Mansoor, Budgetary Impact of Privatization, pp. 52-53.

⁸⁰Deputy Prime Minister (Planning and Development), "Financial Bona Fides of ATN and Appropriateness of Price," memorandum to Commissioner of Inland Revenue (dated 26 January, 1990): pp. 2-3.

financial statements give a true and correct view of the state of the corporation's affairs.⁸¹

5.3 Alternatives To The Sale Of Shares

One question which cannot be escaped is: need the GOG have divested GTC? The evidence is that the GOG was committed to GTC's divestiture. Yet, there are those who are of the view that the GOG should have GTC within the budget, effect realistic tariffs, and allow the firm ready access to the foreign currency earnings to effect timely maintenance, rehabilitation, and modernization. Indeed, so the argument goes, some foreign borrowing might also have been sought to accelerate the process. It is difficult to be sanguine about the implementation success of this option.

A more realistic option might have been to take the entity out of the budget, mortgage the assets for sufficient funds to implement rehabilitation and modernization, and contract out the management to a competent foreign firm. After all, as shall be shown, the assets were eventually mortgaged to mobilize investment funds.

A popular and apparently persuasive view of the option the GOG ought to have exercised has been stated by the then Minister of Finance as follows:

. . . In other countries where the expansion and modernization of the system were the main objectives of policy, it has been undertaken not by wholesale divestment but via sale of the rights to install digital overlay networks and/or new services and capabilities. The latter may include new niches and specialized networks where rapid technological advances have removed the "publicness" of the service and permitted competition in business communications and services such as cellular, paging, data communications and satellite and value added services. In Addition, the installation and operations have been sub-contracted.⁸²

⁸¹Thomas, Stoll, Dias & Co., Report of the Auditors to the Members of Guyana Telecommunication Corporation on the Financial Statements For the Years Ended 31 December, 1985 to 1989 (Georgetown).

⁸²The Re-Privatization of Guyana, by Carl Greenidge, pp. 292.

This option has to be analyzed very carefully.

From a technical perspective, a **digital overlay** network requires an almost identical set of equipment to that required for a normal trunk network.⁸³ In other words, the investment requirements are significant. Another consideration of consequence is that of compatibility:

Every overlay network will not only have to be compatible with existing standards, but as a trunk network would have to interface with many different types of equipment existing in the network. The engineering requirements, and the cost of systems development, should not be underestimated.⁸⁴

So, this option could be problematic and costly, even though it addresses only the trunk system.

The Guyana Investment Policy specifically addresses governments willingness to entertain discussions on all possible permutations of private and government/private ownership.⁸⁵ But, there is no evidence of any investors wishing to participate along the lines suggested in the quotation above. So, although advances in technology may have moved telecommunications out of the "natural monopoly" category, the objective reality in the country in question should not be ignored. By any indicator, save land mass, Guyana is a very small country and it is doubtful whether there really was room for competition in the provision of trunk and international services.

The following statement supports this argument:

. . . In small and somewhat spatially dispersed networks typically found in small- and medium-sized developing countries, if the management of the major public telecommunications operating entity is efficient, cost conscious,

⁸³When we turn, in the next section, to the licence granted GT&T we shall examine such service niches as international teleport and data communications networks.

⁸⁴William Ambrose, Paul Hennemeyer, and Jean-Paul Chapon, "Privatizing Telecommunications Systems: Business Opportunities in Developing Countries," International Financial Corporation Discussion Paper 10 (November 1990): p. 18

⁸⁵Government of Guyana, State Paper: The Guyana Investment Policy, pp. 3-6.

and service oriented, and if adequate resources are available to them, most public telecommunications services can probably be provided most cost-effectively by a single monopolistic entity with nationwide coverage.⁸⁶

All this notwithstanding, it remains imperative that all modalities of competition be explored. After all, it is widely accepted that even in networks as small and spatially dispersed as Guyana's, it is possible to benefit from competition in areas such as equipment supply and provision of cellular telephone.⁸⁷ This is an issue to which the essay shall return.

Finally, contrary to the impression conveyed by the Minister's statement, de-monopolization ought not to be seen as the only way to capture the most appropriate or the best of technologies. At least in theory, the same benefits might be realized via divestiture of an integrated entity. What may be true is that, in the latter approach, imaginative regulatory design and commitment to its enforcement assume greater import.

5.4 Discussion to Section 5

The evidence suggests that the GOG did not explore any privatization option save the sale of the entire network as an integrated entity. This must be deemed an error in judgement. However, having decided on the divestiture option the GOG, whether it was aware of it or not, was correct not to preoccupy itself with independent valuations of the assets to be disposed of and not to make sale price an end in itself.

There were a variety of factors which ensured that the sale price would be heavily discounted. For example, the inappropriateness of GTC's equipment and technology, the untidiness and inaccuracy of its accounts, and the fact that the regulatory mechanism was still unknown. Also, one ought not to ignore the possibility of corruption, the generally poor state of the country's infrastructure, and "the added complication of valuing 'goodwill'."⁸⁸ Then, too, the GOG's handling of the GTC divestiture - its reluctance to divulge information or to encourage wide

⁸⁶Saunders, Warford, and Wellenius, Telecommunications and Economic Development, p. 59.

⁸⁷Ibid., pp. 283-284; Ambrose, Hennemeyer, and Chapon, Privatizing Telecommunications Systems, p. 28.

⁸⁸For a discussion of these considerations see, Carl Greenidge, The Re-Privatization of Guyana, pp. 292-294).

participation in the process - served to aggravate the valuation and sale price controversy.

One major difficulty with the divestiture option was that it presupposed an ability to deal effectively with regulation. But reference to the theory, or experiences in even the developed countries, would have demonstrated the folly of so believing. In Guyana, the new entity would commence operation and three months would elapse before the Chairman and Members of the PUC were even named. An inauspicious start to the process of regulation.

SECTION 6

REGULATION, COMPETITION, AND THE NEW ENTITY

6.1 The Joint Venture Partner--ATN

ATN is a private limited liability company incorporated in the United States of America. Its principal office is in the United States Virgin Island where it operates a reasonably modern voice and data transmission system (VITELCO). ATN's interest in Guyana appears to be guided by a strategy to expand within Latin America and the Caribbean. In addition to GT&T, ATN has six other subsidiaries, all of which are in the telecommunications industry.⁸⁹

The GOG sought to be assured that it was dealing with a reputable and capable company. ATN's consolidated Financial Statements and Independent Auditor's Reports were studied as were the curricula vitae of its senior personnel; technical teams were sent to VITELCO to assess ATN's engineering/technical and financial strengths; and information was sought from the financial and regulatory agencies with whom ATN has had dealings.⁹⁰

While government's Financial Advisers were satisfied with ATN, independently gathered information was not always

⁸⁹The subsidiaries are:- i) VITELCO; ii) VITELCOM CELLULAR; iii) Maritime Cellular Tele-Network Inc. (MCN); iv) CALLS (which resells long distance service in the Virgin Islands); v) VITELCOM Inc.; and, vi) Puerto Rico Telecom (PRT).

⁹⁰For example, ATN's insurers and the Federal Communications Commission in Washington.

flattering to the Company. For instance, one GOG representative in Washington provided information to the effect that: 1) having taken over VITELCO in 1987, by 1989 ATN had borrowed US\$170 million (relative to VITELCO's purchase price of US\$86 million) and that VITELCO was eventually "charged with the full US\$104 loan originally contracted,"⁹¹ and 2) based on an analysis of VITELCO's Balance Sheets and Operating Statements, even assuming the most dynamic growth path, VITELCO remains a small operation. The latter point was made to support the view that ATN lacked the experience to rehabilitate, modernize, and operate the national network.

The Committee established "to assess the financial bona fides and status"⁹² of ATN concurred with these sentiments and went further to argue that: 1) ATN's corporate structure reflected the practice of corporate layering,⁹³ 2) its accounts suggest a company likely to borrow resources by pledging the assets of GT&T and, therefore, with little to lose when and if it pulls out of the operation, and 3) ATN's financial transactions were shrouded in a veil of secrecy.

The Committee concluded that, the risks attendant on finalizing a contract with ATN were unacceptably high, and that "it is highly risky to entrust the operations of GTC to ATN, that is a course to be avoided if possible."⁹⁴ ATN's technical and financial abilities, or the lack thereof, is now an empirical question, the resolution of which shall be attempted by an appeal to the evidence. This task shall be taken up later.

⁹¹Joseph Tyndall, "Letter to His Excellency the President," (dated 26 January, 1990): pp 1-3.

⁹²Carl Greenidge, *The Re-Privatization of Guyana*, p. 286.

⁹³This is a tactic used to circumvent taxation, milk profitable companies, and generally hide malpractice. An example was provided of ATN borrowing funds at a subsidized rate from the Rural Electrification Agency in the USA and on-lending it to VITELCO at 1.5 percent above the prime rate in the USA.

⁹⁴Evelyn Wayne, "Memorandum: Notes on Comments by Mr. Michael Adda and Conclusions Drawn by the Team Appointed to Study ATN's Financial Capability and Related Matters," State Planning Secretariat memorandum dated 29 February, 1990.

6.1.1 ATN's Responsibilities Under the Agreement

Under the Agreement consummated between the GOG and ATN, the latter's principal obligations might be summarized as:⁹⁵ 1) to prepare and implement, within a 3-year period, a comprehensive Expansion and Service Improvement Plan worth some US\$80 million, 2) to maintain and upgrade the quality of the service in keeping with international standards, 3) to pay in convertible currency taxes due on net income from international services, 4) to retain all inherited employees for at least 18 months, promote training, re-training and career development, and provide employees with health and retirement benefits, 5) to maintain existing tariffs for a minimum of 3 years from the date of the Agreement,⁹⁶ and 6) to maintain adequate insurance on property, plant and equipment.

6.2 Catering for Competition in the Sector

6.2.1 The Licence

Based on the terms of its licence,⁹⁷ GT&T has been granted:

- 1) exclusive permission for a period of 20 years, renewable at its option on an exclusive basis for a period of 5 years, to undertake: a) public, radio, and pay station telephones services, and national and international voice and data transmission services, b) sale of advertising in

⁹⁵See appendix 1 for a summary of the 3-year investment programme and what it was intended to accomplish, and appendix 2 for the quality of service indicators.

⁹⁶The agreed "special circumstances" that can trigger changes in tariffs are: 1) a **substantial** increase, over a period of six months, in the average selling price of the US\$ over the selling price prevailing at the time of the signing of the agreement; 2) changes in long distance charges payable to foreign correspondents; 3) acts of God resulting in extensive destruction of property, plant and equipment; 4) cost of providing service to the hinterland proving to be well in excess of that estimated in the Expansion Plan.

⁹⁷The licence fee was fixed at an initial payment of US\$1.0 million and, as of 01 January, 1992, an annual payment, in United States dollars, equivalent to 0.1 percent of the Company's annual turnover in the preceding year. This approach is similar to that adopted in Britain.

directories, and c) switched or non-switched private line service supported by facilities constructed over public right of way;

2) exclusive permission for a period of 10 years, renewable at its option for a period of 10 years, to undertake: a) supply of terminal and customer premises equipment, b) telefax, telex, telegraph, and telefax network services (without prejudice to other persons right to sell telefax and teleprinter machines and maintain these equipment as well as operate facilities for sending and receiving such messages); and,

3) non-exclusive permission for a period of 20 years to provide cellular radio telephone services.

The licence grants a monopoly in local wire-line telephone service: hardly a contentious issue, since it is widely held that with the existing technology, this is an area in which economies of scale are likely to be important and competition generally undesirable. But, the licence excludes "private radio telephone systems which do not interconnect with the licensee's network."⁹⁸

This means that paging networks, private satellite business networks, international teleport, and other such specialized niches, are spheres in which room has been left for competition.

The licensee is obligated, if requested, to connect and keep connected, connectable systems. Thus, there also exists room for competition in such niches as data communications networks, and the host of associated value-added services which these make possible.

Instructively, the licence is non-exclusive with regards the supply and maintenance of terminal and premises equipment, and the operation of facilities to send and receive telefax copies and teleprinter messages. This is as it ought to be since competition in these areas is generally held to be both feasible and beneficial (subject always, of course, to enforcement of some set of technical

⁹⁸This arrangement promotes competition by making it possible for large users to set up their own facilities. Indeed, in Trinidad & Tobago, it led to the creation of private facilities even though there existed idle capacity in the national network (see, "Third World Telecom Development: Trinidad and Tobago," The Telecom Market Letter 10 (July 1988): pp. 4-5.

standards). Equally instructively, the licence for provision of cellular service is non-exclusive. Again, this is as it ought to be. These technologies are developing so rapidly that one would not want to grant any operator a monopoly in this sphere of the industry.

Finally, the licence deals specifically with what is referred to as "Fair Dealings and Further Provisions Concerning Competition," and with the very important issue of "Wrongful Cross Subsidy". The latter's importance derives from the fact that if practiced, it could facilitate the incumbent operator's use of price as an instrument for keeping out potential competitors.

6.3 The Applicable Regulatory Framework

The clauses enshrined in a licence will not ensure compliance. The theory is clear: ensuring compliance will depend on the design and effectiveness of the regulatory framework. The objective of regulation is to prevent commercial abuse by an operator who has a dominant or monopoly market position. Pursuit of this objective necessitates 1) limiting the tariffs which the operator can set for services provided and 2) ensuring that a reasonable standard of service is provided to consumers. When the object of analysis is a utility as strategic as telecommunication, some thought also has to be given to social objectives.

The Public Utilities Commission Act came into effect on 1 October, 1990.⁹⁹ One can cull from the legislation the following objectives of regulations: 1) to ensure the operator's ability to finance, modernize, and maintain the system, 2) to universalize the service, 3) to promote consumer interests, and 4) to promote competition, cost efficiency, and research and development.

The Commission was designed to operate on three fronts combining, administrative, policy, and adjudication functions. Thus, it is supposed to conduct research, monitor, investigate, convene hearings, receive and study operators' records, issue orders, allow appeals, approve rate changes, vet capital programmes, advise the responsible Minister and prepare an annual report which the said Minister is supposed to lay before Parliament.

⁹⁹Note that simultaneously the GOG also introduced the Telecommunications Act which provides for a Director of Telecommunications. There is potential for conflict since the spheres of authority of the PUC Commissioner and the Director of Telecommunications are not clear.

That this approach to regulation should have been adopted is unfortunate, inexplicable, and inexcusable. The GOG was advised, by one of the Consultants on whose expertise it drew, that,

it is very costly, in that it uses considerable human resources in preparing documentation, carrying out investigations, etc. . . . is inherently adversarial, provides excellent business for lawyers and results in long, drawn out rate cases . . . In practice the system leads to inefficiency and delay.¹⁰⁰

This prognosis has proven to be accurate. Currently, the Chairman apart, the Commission has 2 non-clerical staff members, neither of whom has either been trained as an engineering or has an engineer background. Not surprisingly, therefore, the Commission has undertaken no monitoring. To date, there has been one application by the GT&T for tariff increases and the hearing convened to facilitate the Commission's decision lasted for more than six months--application dated 15 April, 1991, decision dated 12 November, 1991).¹⁰¹

This lack of technical staff has meant that, for the hearings, a consultancy firm had to be contracted to examine the Company's accounts, and two Legal Advisers to be present at the hearing. Many a GT&T/PCU battle have been fought in the press and currently, the GT&T has some 6 cases before the courts as ATN seeks to defy the Commission.¹⁰² In other words, the GT&T/PUC relationship is adversarial.

That no serious work is routinely done by the Commission is best illustrated by the fact that, to date,

¹⁰⁰Elizabeth Hunt (Consultant), "Guyana: The Regulatory Framework," A note, dated 12 November, 1990.

¹⁰¹See, Public Utilities Commission, Application of The Guyana Telephone and Telegraph Ltd. for Rate Increases: Decision, November 12, 1991, pp. 1-2.

¹⁰²These cases have to do with orders issued by the Commission with regards: the employment of foreign nationals, the provision of data and information to the Commission, dealings with foreign correspondents, installation of public phone booths, and the reimbursement of expenditures associated with the Hearing. Incidentally, this information (i.e. the fact that these cases are before the courts) was the only bit I was able to get from the Commission.

the Commission has never prepared and submitted to the competent Minister for presentation in the National Assembly "a report in respect of the preceding calendar year," in compliance with Article 85 (1) and (2) of the Public Utilities Commission Act.¹⁰³

That the Commission has failed in the discharge of its mandate as it relates to research, monitoring, surveillance, and reporting could hardly be disputed. Some consideration must now be given to the Commission's performance as it relates to enforcement. After all, this is the activity that gives effect to the provisions of the licence and legislation.

6.3.1 Early Experiences with Regulation

To date, much has transpired to suggest that unless the regulatory body asserts itself, enforcement will become a real problem and efforts at encouraging competition in the telecommunications sector will be frustrated.

Section 38 of the PUC Act of 1990 stipulates that the tariff rates in effect on 1 October, 1990 shall not be increased for a period of three years, except in the event of certain special circumstances.¹⁰⁴ This initial period comes to an end on 30 September, 1993. However, on 15 April, 1991 GT&T gave notice of its desire to effect changes in its rates, as of 20 May, 1991. The request, after being amended twice, covered telex rates, telephone collection rates, and telegraph collection rates. The request was justified¹⁰⁵ but, the hearings exposed serious malpractice and violations of the terms of the licence and PUC Act. It is to these that we now turn.

6.3.1.1 Third Party Transactions

For the period March to July, 1991 GT&T advanced ATN US\$4.9 million - the equivalent of 68 percent of total outflow from GT&T's overseas bank accounts and three months of its gross revenues - without the knowledge of the Board of Directors, supposedly to invest on the Company's behalf.

¶

¹⁰³See, Guyana, Public Utilities Commission Act, 1990, Article 85.

¹⁰⁴See footnote 96.

¹⁰⁵The unification of the official and parallel market exchange rates on 20 February, 1991 caused the exchange rate to move from G\$ G\$45/US\$1 to G\$128/US\$1 by April, 1991. This fulfilled the exchange rate depreciation eventuality.

However, there existed no evidence of the investments effected, no information of investment interest paid or accrued, and no verification (by way of bank documents) for US\$1.1 million of the amount. Indeed, investigation revealed that some US\$2 million of the total represented payments to ten companies and individuals with which GT&T had no business relationship but all of whom were either employees or subsidiaries of ATN.

This type of manoeuvring is typical of multinational corporations seeking to transfer surplus foreign-denominated funds to their parent companies, reduce their exposure to devaluation, or hedge against inflation. From Guyana's perspective, this type of activity creams off re-investible funds,¹⁰⁶ encourages more external borrowing that might otherwise be necessary, undermines the flow of funds to the Treasury,¹⁰⁷ inflates operating cost, and penalizes consumers.

It merits observing that the Company's heavy participation in the liberalized foreign exchange market (for the purpose of transferring funds) could have conditioned a greater devaluation of the domestic currency than would have otherwise occurred. In other words, the Company may have been instrumental in bringing about one of the agreed eventualities for a rate increase: a substantial devaluation of the Guyana dollar. This view is given credence by the Commission's finding:

During the period February to April, 1991 GT&T spent approximately G\$421m (US\$3.045m) in the purchase of foreign currency. These purchases were effected largely with local funds inherited from GTC and standing in deposit and current accounts with the local banks.¹⁰⁸

¹⁰⁶ATN's agreement with the GOG stipulates that for the first 3 years all surpluses will be re-invested in network expansion and modernization.

¹⁰⁷If borrowing is higher than it would have been, then interest is higher than it would have been. So, current expenditures turns out to be higher, and the operating surplus on which taxes and dividends are paid is lower. Government loses.

¹⁰⁸Public Utilities Commission, "Application of The Guyana Telephone and Telegraph Ltd. for Rate Increases: Decision, November 12, 1991," p. 33.

The hearings revealed that "without any satisfactory justification,"¹⁰⁹ GT&T entered into an advisory contract with ATN under which the latter's monthly take is 6 percent of the former's gross revenues, plus full reimbursement of personnel, materials and overhead expenditures. Again, this facilitates bleeding the Company, transferring funds, and inflating operating expenditures.

6.3.1.2 Accounting Issues

The hearing exposed a lack of clarity and transparency in the Company's accounts and the fact that, contrary to the terms of the licence, the accounts were "mixed and interwoven" with those of other ATN subsidiaries. For instance, it revealed that,

the financial management of GT&T is in the hands of ATN with the officer in charge of GT&T's finances being the Chief Financial Officer of ATN and with the second in command being the Assistant Financial Controller of VITELCO, even though neither of these officers is in the employment of GT&T.¹¹⁰

The Company's accounting system proved to be quite untidy. Of import was the fact, not only were there serious deficiencies in production cost information but there was no separation of accounts for different service components. For example, the Company was in no position to provide a detailed disaggregation of costs between the local and international services. This is a serious violation of the terms of the licence. Detailed cost of production information is critical if the Commission is to ensure that costs unrelated to operations are not being borne by consumers. Further, separate accounts is the surest way to monitor issues such as cross-subsidy. How else could the regulatory body establish whether GT&T is providing say, cellular telephone service, at below cost, by using profits from another aspect of operations?

Another important issue was the Company's inability or refusal to produce agreements in relation to the accounting rates it claimed were currently applicable. The implication here is self-evident. To the extent that accounting rates are inflated, the difference between the actual accounting rate and the one used in the accounts represents revenue earned but not reflected. Reflecting less than actual revenues while maintaining or inflating costs, lowers the

¹⁰⁹Ibid., p. 38-42.

¹¹⁰Ibid., p. 54.

Company's tax liabilities. Again, flows to the Treasury suffers.

6.4 Discussion to Section 6

Despite the relative speed with which the GTC divestiture was completed, the major documents (the GOG/ATN Agreement, the licence, and the PUC Act) reflect the inputs of individuals who drew on wide-ranging and current experiences in their design. But, the advice of the Consultants' was not always heeded. Thus, there are aspects of these documents with which these professionals cannot be associated.¹¹¹

But the high quality of these documents is insufficient to impose discipline on a multinational corporation. The skeptics and gainsayers were correct: the experience to date suggests that ATN could hardly be considered the ideal joint venture partner in a utility as important as telecommunication.

It is true that during its relatively short existence, ATN has not caused GT&T to take active steps to frustrate entry by potential competitors into any segment of the industry. This might be because no serious potential competitor has so far appeared.

ATN's discharge of its corporate citizenship to date leaves much to be desired. For instance, ATN has six cases before the courts in its efforts to flaunt the regulatory authority. The situation is made worst by the obvious inability of the regulatory body to carry out its mandate regarding research, surveillance and monitoring. The future of this joint venture relationship does not seem very auspicious. The state of the Company's accounts, its refusal to provide access to information, the manner in which it conducts third party transactions, all point to an effort by ATN to make a quick profit by taking more than its due. One would be justified, it seems, in believing that whatever resources flow to the Treasury are less than they ought to be.

Fortunately, provision has been made for the cancellation of the licence in the event that either ATN or GT&T contravenes its material terms or any of those of the Agreement or the Postal and Telegraph Act under which the licence is granted. The evidence suggests that, unless ATN's corporate behaviour were to change for the better,

¹¹¹For instance, they argued for one regulatory authority, a British approach to regulation, and more precise specification of the criteria for rate increases.

the GOG will be forced to revoke the licence. Unfortunately, as shall be shown later, this course of action would leave the GOG with another multinational with whom to deal.

SECTION 7

GT&T's PHYSICAL AND FINANCIAL PERFORMANCE

7.1 Evaluation of Network Achievements

7.1.1 The Expansion Programme

The fact that the objectives of the GTC divestiture were stated in terms of rehabilitation, expansion, and modernization of the public network makes the agreed Expansion and Service Improvement Programme central to any assessment of benefits from the divestiture.

A most important observation in this regard concerns financing. To consummate its Agreement with the GOG, as well as to implement the agreed Programme, ATN had to borrow funds from NTIF. To consummate these deals, its shares in GT&T had to be pledged in favour of the NTIF.¹¹² There is evidence that the GOG became aware of ATN's financial crunch before the GOG/ATN Agreement was finalized.

7.1.1.1 Programme Slippage

Sometime early in 1993, ATN requested of the GOG, and obtained, a re-phasing of the Programme. ATN has this request on the basis of suppliers' delays, and theft and willful destruction of property locally. Thus, whereas the scope of agreed works remains unchanged, the time-frames (see appendix 1) are no longer applicable.¹¹³ At least one implication of this re-phasing are clear: at minimum, there must result a postponement of some of the benefits expected from the divestiture. It must be true, too, that government's argument for accepting a heavily discounted

¹¹²GT&T now owes NTIF a loan of US\$11.113 million and notes payable of US\$7.3 million. The applicable rates of interest are 11.75 and 7.875 percent respectively.

¹¹³Kenneth Narine, interview held at Office of the Public Utilities Commission, Brickdam, Georgetown, March 1993.

sale price - the imperative of an immediate, comprehensive, investment programme - has been, at least partially, undermined.

7.1.2 Expansion Programme Achievements

Between February 1991 and April 1992, ATN expended some US\$30 million on rehabilitation and expansion of the network. The two most important developments were the installation of the main digital switch in Georgetown and upgrading of the earth station. Observe, that the latter activity more than doubled the circuits on the main traffic streams, from 70 to 145.¹¹⁴

As at end-March 1993, two years after take-over, some US\$50 million had been expended on the agreed Programme.¹¹⁵ The actual accomplishments to date are set out in Table 5 below. Data could not be had to assess performance against the agreed quality-of-service targets set out in Table 10 in appendix 2.

It seems logical to conclude, though, that the new digital switch and the rehabilitation works would have improved the quality of service. The following examples serve to support this conclusion 1) the call completion rate stood at 50 percent in March, 1993 and 2) the ratio of incoming to outgoing calls declined from 4.3:1 in 1990 to 2.6:1 at end 1991, and 3) improvements in the network and services occurred even as the work force was slashed by roughly 50 percent.¹¹⁶

What is obvious, however, is that insofar as the time-frames for the various components of the agreed Programme have been re-phased, the targets set for the quality-of-service indicators could hardly be met as yet.

¹¹⁴Circuits to the USA moved from 53 to 108; the UK, from 10 to 25; and Canada, from 7 to 12.

¹¹⁵Stabroek (Georgetown) News, 23 March, 1993.

¹¹⁶Securities and Exchange Commission, "ATN Form 10-K for Fiscal Year ended December 31, 1991," p. 25.

TABLE 5

NETWORK REHABILITATION AND EXPANSION ACHIEVEMENTS

CATEGORY	REMARKS
<u>ADMINISTRATION</u> Labour Related: Billing: Traffic: Repair:	-Salaries aligned with best private sector employers (a 330 percent increase) -Pension Plan & Health Insurance schemes established -Trade Union Representation Agreed -Billing automated and supported by appropriate equipment and software -Traffic department restructured -Installation & repair Department restructured
<u>SWITCHING</u>	-Host digital switch installed in Georgetown -Earth Station upgraded and international circuits on main traffic stream (USA, UK, Canada) increased from 70 to 145 Added 1,100 new lines and completely rebuilt 4,400 lines (at March 1992) -Remote digital switches installed at New Amsterdam (Dec. 1992), Diamond (Feb. 1993), Timehri & Bartica (Mar. 1993), Skeldon (April 1993) and Beterverwagting and subscriber lines cut over to the new switches
<u>TRANSMISSION</u>	-Commencement of line replacement and expansion in Georgetown, New Hope, Timehri, New Amsterdam, Skeldon and Beterverwagting, using fiber optic cables
<u>NEW SERVICES</u>	-Cellular (MTX) switch installed and cellular service made available -Installation of public telephones in Georgetown
<u>MISCELLANEOUS</u>	-Installation of redundant power supply equipment at the Head Office and the international Station -Improvement and expansion of transportation fleet

Sources: a) Interview held with GT&T's Commercial Manager in March, 1993; b) Stabroek News, 23 March, 1993.

7.2 Financial Performance

Table 6 summarizes GT&T's financial performance for the years ended 31 December, 1991 and 1992. The numbers reveal that there has occurred a major improvement over GTC's best financial out-turn (in 1990) and that 1992's performance represents a significant improvement on 1991's.

For example, in 1991, net international long-distance revenues amounted to US\$24.29 million, with the following distribution: incoming traffic, US\$17.67 million; outgoing traffic, US\$6.61.¹¹⁷

By contrast, in its best year, the figures for GTC were US\$9.61 million and US\$5.01 million, respectively. By 1992, net international long-distance revenues had increased by 53 percent over its 1991 level. One observes also, the new company's earnings per share. It moved from an impressive US\$308.7 per US\$1 share in 1991, to US\$491 per US\$1 share in 1992.

The dramatic improvement in international long-distance revenues so quickly after divestiture appears to be a function of three principal factors: 1) the increase in international circuits, 2) network rehabilitation and the increase in lines in service, and 3) remunerative international collection charges.¹¹⁸ The first two factors would have occasioned an increase in total international paid minutes; the third would have increased the value of these minutes; the third factor would have increased the value of these minutes.

¹¹⁷This revenue disaggregation was obtained from Godfrey Statia, Senior Deputy Commissioner of Inland Revenue, interview held at his office, Robb Street, Georgetown, Guyana, 23 March, 1993.

¹¹⁸On 12 November, 1991 the PUC granted an increase of approximately 160 percent in GT&T's rates for calls to the USA and the UK, and 96 percent for calls to Canada (retroactive effect from 20 May, 1991).

TABLE 6
ABRIDGED INCOME STATEMENT FOR GT&T
FOR YEAR ENDED 31 DECEMBER, 1991

US\$ millions

REVENUE AND EXPENDITURE CATEGORY	1991	1992
Total Revenues	24.760	37.193
International Inbound Traffic	17.670	...
Outbound Traffic	6.610	...
Other Revenues	0.480	...
Total Operating Expenditures	18.780	25.640
International Long-Distance	7.480	11.920
Depreciation	0.608	1.170
Foreign Exchange Loss	0.771	0.000
Income & Corporate Taxes	5.107	5.510
Property Taxes	0.167	0.196
Other Expenses	6.647	6.844
Operating Income	5.980	12.350
Non-Operating Income	0.860	0.180
Total Income Available	6.850	12.470
Less Interest Expenses	0.477	2.350
Net Income & Retained Earnings	6.368	10.130
Earnings Per US\$1	308.7 **	491.0 **

Source: Deloitte & Touche, Report of the Auditors to the Members of Guyana Telephone and Telegraph Co. Ltd. 09 March, 1992.

Note: ** These are to be read hundreds of US\$.

Indeed, the first two factors explain the impressive average annual rate of growth--62 percent (incoming), and 123.6 percent (outgoing)--in overseas paid minutes within one year of takeover. Table 7 below shows the movement in overseas paid minutes for the period 1989-91.

Given the higher level of turnover, it is hardly surprising that taxes paid in both year were well in

excess of the total transfers of US\$4.43 (taxes plus dividends) garnered from GTC, in its best year.¹¹⁹

TABLE 7

TOTAL INTERNATIONAL PAID MINUTES, 1989-91

Million minutes

TRAFFIC CATEGORY	1989	1990	1991
INCOMING TRAFFIC	11.08	12.90	20.9
OUTGOING TRAFFIC	5.10	4.06	9.08

Source: Enterprise Monitoring Division, Secretariat: State Planning Commission, 16 March, 1993.

Even without reference to the earnings per share, it is easy to see how lucrative the network became within one year. In 1991, operating expenses (after allowance is made for international long-distance expenses of US\$7.48 million, depreciation expenses of US\$607,570, and foreign exchange losses of US\$770,552) amounted to US\$4.46 million,¹²⁰ which is easily covered by outgoing international traffic revenues of US\$6.61 million. In other words, when international long-distance expenses (US\$7.48 million) are deducted from incoming receipts (US\$17.67 million), the company is left with US\$10.19 million, and can continue operations without touching these funds.¹²¹

7.3 Discussion to Section 7

It seems the GOG had a fixation on privatizing GTC in the way that it did. This conclusion is supported by at least two facts 1) no other privatization option was ever contemplated and 2) the Agreement with ATN was consummated

¹¹⁹I received no explanation why, contrary to the ATN/GOG Agreement, GT&T's taxes on international revenues are not being paid in foreign exchange.

¹²⁰Note, taxes paid (US\$5.27 million) are not allowed for here since these cannot legitimately be deemed operating expenses.

¹²¹In addition, given what came out at the hearing, there is a high probability that the number used in the accounts understate the actual out-turn of the international network.

though it was known that ATN was "strapped for cash." That ATN has bought into a very lucrative operation, as well as negotiated a very good deal for itself, is beyond dispute. But negotiation ought to leave both parties pleased with themselves. The question then, becomes: How pleased is the GOG with the joint venture deal?

True, the investment programme has lagged, but the objectives of the divestiture have begun to materialize. The change in ownership has already resulted in improved performance and this can be made to offset the wealth transfer that occurred with divestiture.¹²² Note that under the same tax regime as GTC, GT&T contributed more revenues to the Treasury. This contribution can be increased via a change in the tax rate. In fact, the National Budget of 1993 increased GT&T's corporate tax rate from 35 percent in 1992 to 45 percent as of January 1993.

From a broader perspective, cognizance must be taken of the impact of improved telecommunications services on the rest of the economy - for example, improved cost efficiency - and its translation into greater financial flows to the Treasury. After all, over the medium- to long-term, budgetary performance depends on performance in the entire economy, not just that of the divested enterprise.

SECTION 8

ESTIMATION OF THE NET (DIRECT) FINANCIAL CONTRIBUTION TO THE TREASURY

8.1 Scenarios 1¹²³

This scenario assumes that GTC were not divested. It assumes further 1) that through to 1995, GTC would have been able to maintain its 1990 level of financial performance and contribution to the Treasury; and 2) that

¹²²GT&T is doubtless inefficient in many regards. But everything is relative. It is clearly more efficient than GTC.

¹²³In the scenarios which follow, the period under consideration is 1990-95. Estimates are used from 1993 onwards. Also, the United States dollars will be used throughout. This us to work with manageable digits. After all, in 1991 and 1992 it took G\$125 to purchase US\$1.

its contribution to the Treasury throughout this period would have been the same as in 1990 (the equivalent of taxes plus dividends). Under these assumptions, the value of the discounted stream of revenues to Treasury would have been US\$20,508 million.¹²⁴

8.2 Scenario 2

But the GTC divestiture did take place. Scenario 2 looks at the Treasury's position based on the following assumptions: 1) On the cash inflow side: i) GT&T 1992 financial performance will hold through to 1995, ii) as of 1993 its flows to the Treasury are determined by a tax rate of 45 percent, and iii) no dividends are paid at any point during the period;¹²⁵ 2) On the cash outflow side: iv) annual GOG revenues foregone as a consequence of divestiture is equivalent to GTC's 1990 transfers v) transaction costs of divestiture equal 5 percent of the sale price, and vi) PUC establishment required US\$0.25 and its annual operating cost is US\$0.25 million; 3) the discount rate is 11.75 percent, the higher of the two interest rates borne by GT&T on investible funds.

The results of this simulation are presented in Table 8. The results indicate that, under the articulated assumptions, the net present value of the Treasury's take over the period would amount to US\$25.7 million. In other words, the Treasury is financially better off for the divestiture.

¹²⁴This scenario amounts to taking the sum of GTC's 1990 tax and dividends payments through to 1995 and discounting them using a rate of 11.75 percent. The discount rate used is justified by the fact that to maintain 1990 financial performance, GTC would have had to borrow funds from NTIF. See n. 61 and point (3) in subsection 8.2.

¹²⁵Remember, GT&T has only common stock. On such stocks Directors decide whether dividends will be paid.

TABLE 8

**SCENARIO 2: COMPUTATION OF NET PRESENT VALUE OF
RESOURCE FLOWS TO THE TREASURY
CONSEQUENT UPON DIVESTITURE
(1990-95)**

US Dollars (millions)

	1990	1991	1992	1993	1994	1995
CASH INFLOW	0.00	23.9	7.5	11.2	11.2	11.2
ATN Share Price ^a	0.00	16.5	.00	.00	.00	.00
Licence ^b	0.00	1.00	2.47	2.47	2.47	2.47
Corp/Inc. Tax ^c	0.00	5.30	4.83	7.17	7.17	7.17
Property Tax	0.00	.167	.197	.197	.197	.197
Dividends ^d						
CASH OUTFLOW ^e	5.4	4.68	4.68	4.68	4.68	4.68
GOG Share Price	4.13	0.00	0.00	0.00	0.00	0.00
Transaction Cost ^f	1.03	0.00	0.00	0.00	0.00	0.00
PUC Set Up/Ops.	0.25	0.25	0.25	0.25	0.25	0.25
GTC Revenue Loss	0.00	4.43	4.43	4.43	4.43	4.43
NET CASH FLOW	-5.4	18.3	2.82	6.48	6.48	6.48
DISCOUNT FACTOR	1.0	1.12	1.25	1.40	1.56	1.74
DISCOUNTED STREAM	-5.4	16.4	2.26	4.65	4.16	3.72
NPV in 1990	25.7					

Notes: Numbers have been rounded, hence their difference from numbers in the text.

^a ATN and GOG shares purchase costs are known (see n. 75).

^b The licence fee and annual payments are given (see n.97).

^c Corporate, income, and property taxes are based on 1992 levels shown in Table 6.

^d GOG/ATN Agreement stipulates that no dividends shall be paid during the first 3 years of operations.

^e All GOG expenditures are treated as having occurred in 1990.

^f Based on the British experience, transaction costs are set at 5 percent of the sale price.

NPV = net present value.

8.3 Scenario 3

If we start with scenario 2 and assume, *ceteris paribus*, that GT&T pays dividends as of 1994 (at a rate of US\$0.32 per share, per annum)¹²⁶ we can generate scenario 3. The results of this simulation suggests that the value of the net stream of revenues to the Treasury would now be in the vicinity of US\$27.34 million. In other words, the Treasury is much better off having divested GTC. The details of this scenario is shown in Table 9.

TABLE 9

SCENARIO 3: COMPUTATION OF NET PRESENT VALUE OF
RESOURCE FLOWS TO THE TREASURY
CONSEQUENT UPON DIVESTITURE
(1990-95)

	1990	1991	1992	1993	1994	1995
CASH INFLOW	0.00	23.0	7.50	11.2	12.5	12.5
ATN Share Payment	0.00	16.5	0.00	0.00	0.00	0.00
Licence Fee	0.00	1.00	2.47	3.80	3.80	3.80
Corp. & Income Tax	0.00	5.30	4.83	7.17	7.17	7.17
Property Tax ^a	0.00	0.17	0.20	0.20	0.20	0.20
Dividends ^b	0.00	0.00	0.00	0.00	1.32	1.32
CASH OUTFLOW	5.4	4.68	4.68	4.68	4.68	4.68
GOG Share Payment	4.13	0.00	0.00	0.00	0.00	0.00
Transaction Costs	1.03	0.00	0.00	0.00	0.00	0.00
PUC Set Up & Ops.	0.25	0.25	0.25	0.25	0.25	0.25
GTC Revenue Loss	0.00	4.43	4.43	4.43	4.43	4.43
NET CASH FLOW	-5.4	18.3	2.82	6.48	7.80	7.80
DISCOUNT FACTOR	1.00	1.12	1.25	1.40	1.56	1.74
DISCOUNTED STREAM	-5.4	16.4	2.26	4.65	5.00	4.48
NPV in 1990	27.3					

Notes: ^a As of 1993, the tax rate (corporate plus income) is computed at 45 percent of gross profits.

^b Dividends computed at US\$0.32 per share (i.e. 4,125 shares times US\$0.32).

NPV = net present value.

¹²⁶According to the SEC's ATN 10-K data, this is the rate of dividends ATN paid its shareholders in 1991.

8.4 Discussion to Section 8

Further Simulations appear to be a pointless exercise. Reason being, such scenarios would have to be based on assumptions of higher tax rate and higher dividends, neither of which can be justified.

Scenarios 2 and 3 are, admittedly, crude. Reason being, they ignore 1) network expansion and improvement beyond 1992, and 2) possible declines in operating cost (consequent upon greater x-efficiency). These factors have the potential to increase flows to the Treasury from corporate and other taxes, annual licence payment, and (possibly) higher dividends.

Unfortunately, given the company's relatively short existence, its refusal to provide detailed production cost data (even to the regulatory Authority), and the apparent non-existence of financial projections (none could be had from either GT&T or the PUC) greater realism cannot be built into the scenarios.

It merits mention that the comparisons between scenarios 2 and 3 and scenario 1 are not strictly comparisons of like with like. For example, GT&T operates with funds borrowed in international capital markets, whereas government would have guaranteed GTC's loans; unlike GTC, inefficiencies can lead to liquidation of GT&T; and, GT&T operates in an economy that has undergone comprehensive liberalization (covering price, exchange rate, interest rates, and imports).

Another consideration of consequence is that the scenarios can give no indication of government's net worth consequent upon GTC divestiture. Having received US\$16.5 million from ATN, the likelihood is that these funds were either invested overseas or used to reduce foreign debt obligations.¹²⁷ In the former case, moreso than the latter, it is obvious that there is a stream of income associated with the use of the funds--a stream which is completely ignored in the scenarios.

However, the scenarios succeed in demonstrating that, even if GT&T were to operate at its current level until 1995, the net financial benefits to the Treasury would exceed that associated with no GTC divestiture. But, equally important, the scenarios also demonstrate how

¹²⁷The US\$16.5 proceeds from the sale of 80 percent of the shares in GT&T was channeled to the Central Bank to meet the fourth quarter 1990 net foreign assets target under the Fund/Bank-sponsored Adjustment Programme.

dependent increased flows to the Treasury are on network expansion and improvement, and effective discharge of the regulatory function. The analysis suggests that government must ensure 1) that the agreed investment programme is executed in its entirety and without undue delays, and 2) that the PUC discharges its mandate effectively. The fact that, to date, neither of these conditions has been satisfied constitutes cause for concern. Further, the analysis brings into sharp relief the seriousness of ATN's conduct as revealed by the hearings held in 1991.

SECTION 9

SUMMARY OF FINDINGS AND CONCLUSION

Between its assumption of office and the divestiture of GTC, the GOG appears to have subscribed to two polar views concerning telecommunications and development. Prior to 1984, it accorded telecommunications a low order of priority, at least from the perspective of access to available resources. Thereafter, its approach to the sector was more activist, as it sought to promote rapid network expansion and service modernization. This pre-1984 view contributed to the excessive deterioration of the national network.

But there was another contributing factor, namely, government's predilection towards dirigiste economic policies. The economy was managed on the basis of controls, and one such control was public sector tariffs. This must explain, at least partially, the reluctance to set GTC tariffs based on a marginal cost basis, the tardiness in adjusting existing tariffs, and the preparedness to accept financial viability as sufficient justification for the continued operations of the Corporation.

The result of these philosophies is clear. The data and information presented in section 4 establish beyond cavil that by the end of the 1980s, initiatives oriented towards rehabilitating, expanding, and modernizing the national telecommunications network were urgently needed. At the same time, even a cursory glance at the major indicators of macroeconomic and financial performance shows that by the late 1980s, fiscal and external imbalances were so severe that the Treasury would have been hard put to effect these initiatives.

Government was not without options. However, the GTC divestiture, while treated by government as such, was not

the only viable option it had. There is no evidence that divestiture was selected after a systematic analysis of the alternatives available. One reason for this might have been the non-existence of a sector policy; failure to articulate a vision for the transformation of the sector over the long-term.

Thus, it is difficult to escape the conclusion that the divestiture of this pivotal utility was undertaken without sufficient analysis, research, and general preparation. This conclusion is further reinforced when one reflects on the controversy surrounding the valuation and share pricing issues. It is true that this paper takes the view that commissioning an independent valuation of the assets might not have diffused the controversy. But it is also true that if the GOG had done its "homework," it would have been forced to grapple with the valuation issue and consequently, would have entered negotiations better informed and prepared and would have been in a better position to counter the allegations of its critics.

The divestiture of GTC demonstrates that legislation and agreements are insufficient for imposing a desired type of conduct on a multinational corporation. It demonstrates also that legislation will not suffice to guarantee some desired level of competition. The realization of both of these objectives, the case study shows, is a function of the design and enforcement of the regulatory regime.

It would seem from the evidence analyzed by this study that the GOG, by not heeding the advice of its Consultants, opted for an inappropriate model of regulation. Given the obvious importance of regulation, government might be well advised to rethink the current approach. It is clear that, at the moment, deficient enforcement is undermining the financial flows to the Treasury.

Although it may be too early in the joint venture relationship to pronounce definitively, it appears that the objectives of the divestiture are being realized. Network rehabilitation, expansion, and modernization are proceeding, albeit not in keeping with the original schedule. The quality of telecommunication services have improved. Government's preoccupation now ought to be to ensure that these developments continue. After all, one of the principal arguments for divestiture was the limitations imposed by the scarcity of investment funds.

But it cannot be sufficient to focus solely on the objectives of the divestiture. Some consideration also has to be given such issues as 1) insights gained into the character of ATN, 2) its demonstrated preparedness to violate laws and agreements, 3) its litigious tactics,

4) its repeated defiance of the regulatory body, and 5) its intent to make quick profits. Unless vigilance is maintained, both consumers and the Treasury will be gouged.

This research has demonstrated that, even while obviously understating the likely quantum of net flows (for example, by ignoring future expansion and improvement and their revenue implications) the Treasury is clearly better off for the GTC divestiture. This is an informative result, especially when one considers that the actual flows on which the projections are based might themselves represent an understatement of what was actually earned by GT&T.

Clearly, GT&T's financial accounting is an area for government and the regulatory authority to keep under close scrutiny. Also, while the Treasury stands to benefit from the divestiture, it remains unclear why GT&T is not being made to pay taxes of its internationally generated revenues in convertible currencies, as stipulated in the ATN/GOG Agreement.

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APPENDIX 1

GT&T EXPANSION & SERVICE IMPROVEMENT PLAN1. BROAD OBJECTIVES

- 1.1 To improve incoming call completion and increase trunk capacity to US, Canada, and UK.
TARGET: completion rate of sixty percent (minimum).
- 1.2 To improve quality of existing cable plant.
TARGET: reduction in fault reports and number of subscribers without lines by one half.
- 1.3 To complete planning and engineering work re extension of service in and around Georgetown, and microwave link to Lethem and other radio links to populated centers.
- 1.4 To connect 20,000 (minimum) additional subscribers within three years.
TARGET: Year 1: 5,000; Year 2: 7,000; Year 3: 8,000.
- 1.5 To complete digitalization of the network and provide service to Tumatumari, Omai, Mahdia, Kurupung, Enachu, Imbaimadai, and areas south of Lethem.
- 1.6 To reorganize internal operations and establish training and motivational programmes.
- 1.7 To continue to connect additional lines to achieve service on demand.

2. INTERIM SERVICE IMPROVEMENTS2.1 Diagnosis

Cable, switching, and faults at subscriber premises account for most of subscriber fault reports. Power problems (generator/battery failure) and microwave failure contribute most to poor service quality.

2.2 Conclusion

Improvements require tools, equipment & spares, and skilled manpower.

2.3 Proposed Measures

- provision of training, equipment, adequate tools and spares

APPENDIX 1 (contd.)

- improvement of supervision, establishment and enforcement of standards, practices, policies and procedures
- appropriate salary increases and merit promotions
- elimination of service and property theft
- ensuring effective administrative procedures (billing, fault report processing, order processing)

2.3.1 Power

To acquire spares for the existing diesel generators which power the microwave sites and provide new engines where necessary.

2.3.2 Switching Equipment

To locate and provide spares for the ERM, Strowger, and ERS switches. (Eventual replacement of Strowger will yield additional spares.

2.3.3 Radio and Microwave Equipment

Acquire used analogue radios for temporary use to ensure reliability of existing routes until these routes are replaced by fiber optic cables or digital radio. N.B Three makes of radios are in use. In one case spares are not available; in another, they are with considerable lead time; and, in the other, only from retired equipment.

2.3.4 Billing Equipment

Evaluate performance and capability [of the existing IBM 360 system and related software] for processing long distance and usage data generated by cellular and DMS switches. (started).

The intention is to install eventually a fully computerized system configured to handle 70,000 accounts and including data communication facilities.

3. SERVICE IMPROVEMENT AND EXPANSION - NEW PLANT

3.1 Yearly Phasing

A demand survey will initiate the expansion programme, beginning with G/T. As soon as the rehabilitation begins public phones will be made available. So will cellular phones.

APPENDIX 1 (contd.)**3.1.1 Year 1**

Work will start with cable installations in the Georgetown business area, New Hope, and Linden. (N.B. it is in these three areas that the target of 5,000 lines in Year 1 is to be met. Year 2 target will depend on the installation of cable plants in New Amsterdam, Suddie, Beterverwagting, and Timehri).

3.1.2 Year 2

- further expand service in Georgetown, Linden, and Timehri
- establish new service to East Coast, between Beterverwagting and Rosignol, and in the Berbice River, between New Amsterdam and Skeldon

3.1.3 Year 3

Further expansion and New Plant will commence installation West of the Demerara (Wales to Parika) and West Essequibo.

3.2 Switching**TABLE 10****SWITCHING EXPANSION AND TARGET COMPLETION DATES**

ACTIVITY	T.C.D.
Installation of DMS switch in Georgetown with 21,000 lines	May 1991
Expansion of DMS line capacity by 10,000 during years 2 & 3	...
Installation of DMS 100 (wired for 5000 and equipped with 2000 lines) and cellular switch in Linden	End August 1991
Bringing the lines into service Commissioning combined load	// // // //
Installation of remote switches	...

Source: Culled from Atlantic Tele-Network, Service Expansion and Improvement Plan (Georgetown: 11 December, 1990).

Note: T.C.D = target completion date.

APPENDIX 1 (contd.)

3.3 Transmission

TABLE 11

TRANSMISSION EXPANSION AND TARGET COMPLETION DATES

ACTIVITY	T.C.D.
Establishment of fiber optic link from G/T to Linden via New Hope and Timehri:	August 1991
Intermediate points to be operational by:	May 91
Microwave link from Timehri to Bartica	Aug'91
G/T to N/A digital transmission link	Dec'91
Eastern transmission link from N/A to Crabwood creek	Mth 21
Digital microwave link to replace existing Timehri/Bartica link	July 1991
Digital microwave link to replace existing Linden/Ituni /Kwakwani link	Nov. 1991
Secondary microwave link to provide service West of Demerara to new digital switches at Leonora, Vreed-en-Hoop, and Tuschen	Mth 34 After EDC

Source: Culled from Atlantic Tele-Network, Service Expansion and Improvement Plan (Georgetown: 11 December, 1990).

Note: T.C.D. = target completion date;
 N/A = New Amsterdam; G/T = Georgetown;
 EDC = expected date of completion.

APPENDIX 2

TABLE 12

GT&T's AGREED QUALITY OF SERVICE TARGETS

INDICATOR	TARGET
Dial Tone Delay	Maximum 2% of attempts
Call Completion Rate Domestic Originating International Terminating International	Greater than 60% between 60 - 95% Greater than 60%
Fault Report Rate	-----
Fault Repair Interval	95 % of reports will be repaired in 48 hours
Connection of Lines First 12-month period Second 12-month period Third 12-month period	20,000 new subscribers in 36 months 5,000 new lines 7,000 new lines 8,000 new lines
Billing Accuracy	Less than 1 billing error in 10,000 calls

Source: Culled from Agreement Between the Government of Guyana and Atlantic Tele-Network for the sale of shares in GT&T, dated 18 June, 1990.

AN ASSESSMENT OF THE RURAL AGRICULTURAL
DEVELOPMENT AUTHORITY'S DELIVERY OF KNOWLEDGE
AND INFORMATION TO FARMERS IN JAMAICA

A Research Paper

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ABSTRACT

An Assessment of
the Rural Agricultural Development Authority's
Delivery of Knowledge and Information to Farmers In Jamaica

Selvyn Lloyd Gilbert

This research paper assesses the Rural Agricultural Development Authority's delivery of extension services to farmers. The study focuses on three main issues, the formulation of RADA's extension activities, the level of response of farmers to these activities, and explanations are sought as to the factors which determine farmers' response. The specific areas examined are training, technology transfer to farmers, and the provision of marketing information.

The study employed a variety of data collection methods: structured interviews, informal discussions, personal observations, and elite interviews. The first four methods were used to obtain information from farmers. Information from managers and extension officers were obtained through elite interviews.

The study found that many farmers were not receiving extension services. Of those who received this service the majority were satisfied and most of these were found to be members of community agricultural groups. Some of the factors which hinder the effectiveness of group extension delivery are corrupt leadership, political clientelism, and lack of local management skills.

Lack of credit, material inputs, and non-availability of labour were main factors which determined farmers' response to RADA's activities.

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SECTION 1

INTRODUCTION

Agriculture is the main engine of economic growth in rural communities. In addition, it plays a critical role in national economic growth. Any policy or programme which seeks to increase the levels of production in the agricultural sector must focus on increasing the productivity of farmers. An efficient extension service can contribute to this by passing on pertinent knowledge and skills to farmers. Difficulties in the extension service can have an adverse impact on the performance of the agricultural sector. It is in this context where small farmers were articulating their need for an effective agricultural extension service that the Rural Agricultural Development Authority (RADA) was founded.¹

The Rural Agricultural Development Authority was established in Jamaica in May 1990 as a means of revitalising the agricultural extension programme. It assumed the duties and functions of the Ministry of Agriculture's extension service. RADA made use of the latter's existing institutional arrangements. For example, many of the senior managers and extension officers at RADA were seconded from the Ministry of Agriculture. In addition, both the zone and parish system of extension contact as well as the physical infrastructure such as offices were kept in place. As a consequence, the organisation was able to begin its extension activities immediately upon its establishment.

The problem of Jamaica's agricultural extension service has been identified by the policy makers as a managerial one. Conceived in this way, what was needed was a revitalisation of the extension service which would only be possible within a "statutory rather than a centrally managed organisation".² According to this perspective, the inability of the extension service to deliver an effective

¹ According to Garnet Brown, Executive Director of RADA, the organisation was founded in response to the cry of farmers regarding the lack of a proper agricultural extension service. See Garnet Brown, "Rural Agricultural Development Authority (RADA) As a Strategy For Promoting Self-Sufficiency," Money Index, August 14, 1990, p. 5.

² Garnet Brown, "Rural Agricultural Development Authority (RADA) As a Strategy For Promoting Self-Sufficiency", Money Index, August 14, 1990, p. 5.

service to farmers was due to the bureaucracy of a central Ministry. The content of Ministry Paper No. 48 giving the reason for the establishment of RADA is indicative:

"In recent times the Agricultural Extension Service has been fraught with the problems of lack of transportation for Extension Officers, low salary levels, a dearth of managerial skills, and the attendant low morale of staff, which goes with these disabilities. Recovery to its former glory through *the bureaucracy of a central Ministry is virtually impossible*³...Adequate room for innovative management and quick response to an ever changing environment must be provided, hence an independent body designed to address this important area of our development...The Rural Agricultural Development Authority (RADA) has therefore been created under the Ministry of Agriculture as a Statutory Body designed to provide the new dynamism which is needed to propel the engine of the Extension Service into positive change and productive directions".⁴

The policy makers, however, failed to take into account the negative impact that economic policies can have on the effectiveness of an extension service despite its managerial structure. In 1992, economic policies necessitated a reduction in staff, "the organisation suffered a staff cutback of 37 per cent"⁵ RADA came to experience the same problems associated with the Extension Service when it was under the Ministry of Agriculture. One such problem, the lack of transportation for extension officers is faced by RADA's extension officers.

Despite these difficulties RADA has been commended for its delivery of extension service to farmers. The Executive Director of RADA stated that in the year in which they experienced a reduction in staff RADA "participated with the farmers to produce some 507 tonnes of domestic

³ Emphasis mine.

⁴ Ministry Paper No. 49, Rural Agricultural Development Authority, Ministry of Agricultural & Commerce, May 15, 1990.

⁵ Garnet Brown, "Message from the Executive Director (RADA)." RADA's Third Anniversary Feature, Sunday Gleaner, June 20, 1993.

foodstuff, which is an all-time record."⁶ In any organisation there are always areas in which improvements can be made. In our case, there are areas of extension delivery in which RADA may need to make improvement. It is the researcher's hope that this study may aid in identifying those areas which need improvement.

1.1 The Rural Agricultural Development Authority (RADA)

RADA focuses primarily on serving small and medium size farmers through the provision of agricultural extension services. Its extension activities include the following:

1. Providing an efficient agricultural extension advisory service to farmers in rural areas in an effort to increase production and productivity.
2. Administering farmer training programmes.
3. Co-operating with agencies involved in the development of rural infrastructure.
4. Developing and operating rural agricultural service centres at strategic locations, thereby bringing service closer to farmers.
5. Liaising with agricultural research organisations with a view to providing a technology link to rural farmers.
6. Providing a channel of information between farmers and policy makers⁷.

RADA is organised on a three-tiered basis - national, zonal, and parish. At the parish level an initiative in interagency co-ordination is now being encouraged by the establishment of Area Development Committees. In addition to being policy formulating bodies, these committees allow for representative participation from farmers in the various districts.

⁶ Garnet Brown, "Message From the Executive Director of RADA." RADA's Third Anniversary Feature, Sunday Gleaner, June 20, 1993, P. A25.

⁷ Edie Gidden and L.A. Henry, A paper presented at a Conference/Workshop on Approaches to Rural Development in Jamaica: Coastal and Hillside Options at the University of the West Indies, November 19 - 21, 1992.

Each parish is headed by a Parish Agricultural Manager who is a member of a Parish Advisory Committee. The Committee assists in the planning of agricultural programmes and also monitors to ensure that programmes are properly executed. The committees also provide advice regarding the agricultural extension and related needs of the farmers in the parish. The Deputy Parish Agricultural Manager is an integral part of this committee as he has direct responsibility for the extension programme of the parish. Each parish has a number of Agricultural Extension Officers, Home Economics Officers, and other technical staff who provide direct services to the farmers. The impact of the Committee on the contents of training and the circumstances in which these are formulated will be discussed in the presentation of the findings.

RADA is organised in two zones, an eastern and a western zone. Each zone has a Zonal Co-ordinator who co-ordinates the planning and delivery of agricultural programmes for the Zone. The parishes that fall within the eastern zone are the following: St. Thomas, St. Andrew/Kingston, St. Catherine, Clarendon, St. Mary, Portland, St. Ann. The western zone comprises the following: Westmoreland, Hanover, St. James, Manchester, St. Elizabeth, Trelawny.

At the National level, the National Board reports to the Minister of Agriculture and consists of a maximum of fifteen members including a Chairman, a Deputy Chairman, and an Executive Director⁸.

RADA operates a number of programmes and projects. Programmes can be distinguished from projects in two significant respects. Programmes are more permanent with no specific time frames. Projects are usually funded outside of RADA's budget, in this case RADA assists in the implementation of the projects. A critical project, worthy of note is the National Yam Export Development Project. The project aims at increasing the export of yams by promoting an improved production system based on what is known as the mini-sett technique.⁹ There is a dichotomy in benefits between farmers who are a part of projects and

⁸ Information on the organisation of RADA was obtained from Edie Gidden and L.A. Henry, A Paper presented at a Conference/Workshop on Approaches to Rural Development in Jamaica: Coastal and Hillside Options at the University of the West Indies, November 19 - 21, 1992.

⁹ The mini-sett technology was used by some of the farmers of our sample. An explanation of it will be provided in section three.

those who are recipients of RADA's other programmes. For example, the former are usually given material inputs while the latter receive little or no assistance in material input. This factor in the absence of communicating to farmers the reasons for the difference in the receipt of benefits negatively impacts on RADA's philosophy of trying to wean farmers away from dependence on subsidies. These points will be discussed in more detail in the presentation of the findings.

Some of the programmes of RADA include the training of extension staff in management, extension methods, and communication methods; nursery production; marketing intelligence and information; crop care; and soil conservation and environmental protection¹⁰. Aspects of these programmes were included as items of enquiry in this research.

1.2 Research Problem

This study focuses on three main issues. Firstly, RADA's activities, specifically, the formulation of content of training, choice of technology, and marketing information. Secondly, the level of response of farmers to RADA's extension activity in the areas of training, acceptance of technology, and the provision of marketing information; and, thirdly, on explanations of farmers' response.

The main research questions addressed under the heading, RADA's activities were the following:

1. How does RADA determine its content of training?
2. How does RADA determine the choice of technology to be passed on to farmers?
3. What types of marketing information are passed on to farmers?
4. What are the communication channels used by the extension officers in passing on knowledge and information to farmers?
5. What factors determine regularity of extension visits?

¹⁰ Edie Gidden and L.A. Henry, A paper presented at a Conference/Workshop on Approaches to Rural Development in Jamaica: Coastal and Hillside Options at the University of the West Indies, November 19 - 21, 1992, pp. 3 - 4.

6. What factors determine the choice of communication methods?

Under farmers' response the main research questions were:

1. What are the opinions of the farmers concerning the effectiveness of the communication channels used by the extension officers?
2. How many farmers receive marketing information?
3. What are the farmers' views on the usefulness of the marketing information provided by RADA?
4. How many farmers are knowledgeable about certain techniques that are taught by RADA?
5. How many farmers utilise the techniques that are taught by RADA?

Regarding the factors influencing farmers' responses the main research questions were:

1. Does the regularity of extension officers' visits influence farmers' response to the agency's extension efforts?
2. Does the format of training influence farmers' response to the agency's extension efforts?
3. To what extent does the educational level of the farmer influence his/her response to the agency's extension efforts?
4. To what extent does the age of the farmer influence his/her response to the agency's extension efforts?
5. To what extent does the sex of the farmer influence his/her response to the agency's extension efforts?
6. To what extent does membership of an agricultural group influence farmers' response to the agency's extension efforts?
7. To what extent does type of tenure influence farmers' response to the agency's extension efforts?
8. To what extent does type of farming influence farmers' response to the agency's extension efforts?

This study is one of the few empirical attempts at assessing the impact of Jamaica's agricultural extension

programme on the knowledge, behaviour, and attitudes of farmers regarding training, technology, and the provision of marketing information. In addition, it is the first case study of the Rural Agricultural Development Authority. Birkhaeuser, Evenson, and Feder have stated that while extension organisations exist in almost every country there is a paucity of empirical work in this area. They affirm that their conclusion is reinforced by the observation that many of the studies reviewed in their article focused on the same countries¹¹. This study enlarges the coverage of countries. As a case study, this research will have practical value for the senior managers and policy-makers at RADA. The results of the analysis of the study will provide information on significant factors which affect the farmers' acquisition and application of what they have been taught by RADA. The identification of the factors may aid policy formation and implementation in that a focus can be brought to those factors.

1.3 Literature Review

So far as is known, there is no published work that attempts to assess the impact of an agricultural extension agency in Jamaica. There are a few articles on agricultural extension agencies in other countries which highlight their impact on farmers' knowledge, adoption and use of technology; many of these studies, however, are focused on cases in India.

In examining the productivity of small farms in India Sen posits a central role for extension service, particularly the Training and Visit systems.¹² Sen's article is important to this study as in his recommendations one can identify certain extension communication variables which may have significant impact on farmers' knowledge, attitudes, and adoption of technology. For example, he recommended that the **verbal message** communicated by the extension officer should be regularly supplemented by printed instructions and radio and television talks.

Regarding the explanation of farmers' response to extension activities, Gershon Feder and Roger Slade

¹¹ Dean Birkhaeuser, Robert E. Evenson, and Gershon Feder, "The Economic Impact of Agricultural Extension: A Review", Economic Development and Cultural Change Vol. 39, no. 3, (April 1991).

¹² S.R. Sen, "A Strategy for our Small Farms", Indian Economic Review Vol. 20, No. 1 (January - June 1985): 143 - 155.

indicate certain explanatory variables which this study has utilised in the Jamaican context. These variables include the extent to which farmers engage in non-farm activities, age of the farmer, ownership status, and educational level of the farmer.¹³ These variables have also been included in Marilyn Clarke's empirical study of agricultural training in Jamaica¹⁴. This study has included membership in farmers' groups as an important variable as it is through these local groups that RADA's extension services are channeled to the farmers.

The role of technology in agricultural development has been recognised in most countries and is reflected in the vibrant discussions in the literature.¹⁵ Within this context the training of farmers in new technologies has become an important part of agricultural extension programmes. Regarding the aspect of appropriate technology, Jeremy Smith points out that technologies may not be adopted due to the absence of the farmers' participation in their formulation¹⁶. This study seeks an insight into this issue as it focuses on the identification of the choice of technology by RADA and the circumstances in which such choice is made.

In a previous empirical work on farmer training in Jamaica Clarke focused on assessing the training needs of farmers in the light of their view of themselves and of their own needs, and to determine the extent to which the

¹³ Gershon Feder and Roger Slade, "A Comparative Analysis of Some Aspects of the Training and Visit System of Agricultural Extension in India," in The Journal of Development Studies Vol 22, No. 2 (January 1986): 407 - 428.

¹⁴ Marilyn Ava Maria Clarke, "A Study of the Perceived Needs of the Jamaican Farmer for Agricultural Training," (MSc Thesis, Cornell University, 1982).

¹⁵ For an example of a technological perspective on agricultural development see Michael Howes and Robert Chambers, "Indigenous Technical Knowledge: Analysis, Implications and Issues," in IDS Bulletin: Rural Development: Whose Knowledge Counts? Vol 10, No. 2 (January 1979): 5 - 11.

¹⁶ Jeremy Swift, "Notes on Traditional Knowledge, Modern Knowledge and Rural Development," IDS Bulletin: Rural Development: Whose Knowledge Counts? Vol 10, No. 2, (January 1979): 41 - 50.

training programmes addressed those needs¹⁷. Clarke's study found that a high proportion of farmers had no idea as to what they wished to be taught; the researcher found that their expressed needs were consistent with the traditional content of extension training programmes. One of the conclusions of the study, however, highlighted the fact that although they were not able to express their needs in terms of training, their knowledge and awareness of community problems may be a helpful factor in determining the training needs of their communities. This study, in addition to examining the content of the training programme, looks at the environment in which the extension services are delivered: logistics; infrastructural support; and the role of local group politics. This approach also helped in assessing the content of the training programmes. Unlike Clarke's approach which depended largely on the articulation of the farmers of their needs, this paper examines factors which give insights as to what ought to be the appropriate content of the training programme.

Extension impact studies have been estimated by use of mainly statistical analysis. Commenting on the problems in the area of analysis, Birkhaeuser, Evenson, and Feder state that the four basic types of agricultural extension impact studies found in the literature require the use of different functional forms and econometric techniques in their analysis.¹⁸ In addition they point out that assessment of extension impact needs to take into account the dynamics of development and the existence of distortions. In order to minimise the difficulties associated with the quantitative analytical approach, and to take into account the factors outlined by the writers, this study has opted to adopt both a quantitative and a qualitative analysis. The latter allows for the probing of issues - the 'why' of the factors. In a context of disjunctures in which the extension services provided by RADA operates, the combining of both a quantitative and a qualitative approach is appropriate.

1.4 Presentation of Paper

Section two of this paper deals with the methodology. In this section I discuss the methods used in collecting the data with a justification for each method used. The general contents of the questionnaire used in the structured surveys and how it was administered will be discussed. Also outlined in this section is the method of

¹⁷ Clarke, op cit., p. 5.

¹⁸ Birkhaeuser, Evenson, and Feder, op cit.

selection of the study population. Validity and reliability are critical concepts underpinning the discussions of the methods, the questionnaire, and the selection of the study population.

In section three the findings are presented. The section begins with a description of the study population highlighting factors which had significant meaning for the study. A description of the age, sex, ownership status, level of education etc. of the study sample of each district is presented. Farmers opinions on the effectiveness of the communication channels and other extension variables will be presented in tabular form. The data presented in section three is subject to both quantitative and qualitative analysis in section four so as to bring out the depth of the reality as experienced by the farmers.

The conclusion then follows in section five. A summary of the major findings of the study is presented. Areas which were tangential to the study but which could not be dealt with in any rigour will be outlined as areas which need further research. The section closes with recommendations.

2. METHODOLOGY

2.1 Introduction

The methodology employed, within constraints, seeks to meet acceptable levels of reliability and validity. The first aspect relates to the means by which access to the farmers were gained. This required the assistance of the extension officers employed to the agency. In addition these officers as well as the managers of the agency would also be important informants due to the focus and nature of the study so access to them as informants was also required. Due to the hierarchical structure of the organisation it was felt that gaining access and full cooperation from the extension officers and the managers, would be easier facilitated if permission for this study were obtained from the Minister of Agriculture and the Executive Director of RADA. The Director of the Consortium Graduate School made the introductory contact between myself and the Minister of Agriculture and the Executive Director of RADA.

They both responded positively to the research proposal. Arrangements were made for me to meet with the Deputy Executive Director and the Senior Director of

Technology and Training. These meetings had three purposes, namely, to explain the objectives of the research; to gain further understanding of the organisation of RADA as it relates to training; and to gain their cooperation in making the introduction to the Parish Managers in whose parishes the research would be carried out. These Parish Managers having learnt of the proposed research then informed their extension officers of the research which would be carried out and asked for their cooperation. The extension officers cooperated by being themselves informants and by facilitating access to the farmers by way of introductions.

Respondents wished their identity to be confidential. In the case of the farmers, confidentiality was secured by not including their names in the report of the findings. RADA staff was concerned that the study would be used to judge work performance. To meet their concerns it was decided that references to interviews in the footnotes would give the dates but not the identity of the informants. The bibliography will give the names of the interviewees but not the dates of the interviews, in this way no cross-reference checks can be made. There are items on the questionnaire which indicate farmers' attitudes to extension officers general performance. To maintain confidentiality these findings are reported as the total sample rather than on a district or parish basis.

The personality of the interviewer and mode of administration can affect the reliability of data collected. In this particular case, the administering of the interviews were undertaken in a manner which was not condescending. My use of the vernacular in parts of conversations and use of terms known to them both in social discourse and in the area of agriculture helped in eliciting information which is more likely to correspond to the reality. Being not employed to the Ministry of Agriculture the perception that the research exercise would facilitate the giving of material help to individuals was lessened. This perception could lead to distortions of the reality. The purpose of the exercise was carefully explained to each respondent and hence my status as an independent researcher was established.

2.2 Data Collection Methods

Data was collected mainly from March to April 1993, although some interviews were conducted in May. Four methods were employed: one, structured surveys; two, informal discussions; three, personal observations; four, elite interviews. It was not possible to acquire data on training content and method of delivery from printed documents. Documents were either non-existent or held to

be confidential.

2.2.1 The Structured Survey

A sample survey of farmers was conducted. Structured survey was considered most suitable as it both allowed for a large coverage of respondents and exposed every informant to the same stimulant. It was used to collect data from the farmers and not from the extension personnel. The specific instrument used was a questionnaire. The low levels of literacy among the farming population required that it be administered through face to face interview. Previous research, in addition to discussions held with lecturers and workers in the agricultural field indicated that this method would be most appropriate, given the low levels of literacy.

RADA's extension activities cover all fourteen parishes in Jamaica. For official purposes, these parishes have been organised into two zones, eastern and western. For this study, one parish, Clarendon, was randomly selected from the eastern zone, and Westmoreland, from the western zone. From each parish, because RADA's extension programme is administered in areas, two areas were randomly selected. In each area three districts were randomly chosen. The number of districts chosen was justified on the following basis. The resulting assessment of RADA would be inclusive of the influence of more than one extension officer per parish. The farmers were selected on a non-random basis as there was no current list of farmers served by RADA in the various districts. In this situation where the current total population of small farmers served by RADA was unknown the non-random method of selecting the farmers was the most feasible. Twenty five farmers were identified in each of the six districts, that is to say, the sample size was one hundred and fifty. The first twenty five persons met who stated an involvement in farming were selected for interviewing.

Although each farmer was not randomly selected the study makes generalisations. This is justified on the following basis: the parishes, areas, and districts were randomly selected. The assumption is that RADA's extension activities are more or less the same for every district. Also, the characteristics of farmers in this sample correspond to those in a previous study based on random selection.¹⁹

¹⁹ Marilyn Ava Maria Clarke, "A Study of the Perceived Needs of the Jamaican Farmer for Agricultural Training," (Msc Thesis, Cornell University, 1982).

2.2.1.1 Design and content of the questionnaire

The questionnaire was designed to elicit the following items of data: the communication channels used by the extension officers, the frequency responses of farmers to the content of what is delivered and how it is delivered, and the extent to which responses were influenced by the personal characteristics of farmers, social or otherwise. Data relating to other objectives of the study, for example, the circumstances in which the extension programme is formulated was obtained by other means which will be outlined. A standardised questionnaire was used. This instrument was designed to meet the data needs of the research and, at the same time, engage the interest of the respondents.²⁰

The questionnaire consisted of four sections to allow for collection of four categories of data. Introductory questions sought background information, including profiles of each respondent's attitude towards his/her occupation. The second section sought data on means other than RADA's extension service by which farmers sought technical advice, physical help, and marketing information. Previous research indicated that these factors played important roles in the life of the small farmer hence it was felt that any interaction with RADA's extension programme was worth identifying.²¹ A third section was devoted to questions on opinions and attitudes of farmers to RADA's extension programmes. The questionnaire concluded with questions seeking background information on the farm and on the farmer which it was felt might impact on extension services. The inclusion of these was informed by the literature concerning variables which were found to be significant in other countries.²²

In this research the majority of the respondents were of low educational background, and there was a language dichotomy. Standard English was spoken by some of the respondents, while others spoke a dialect. Every effort was thus made to present questions in as simple and easily

²⁰ For an in depth discussion of questionnaire design and the and the disadvantages associated with this form of standardised instrument read, Paul B. Sletley, "Questionnaire Construction and Item Writing" in P.H. Rossi, The Handbook of Survey Research, (New York: Academic Press, 1983), pp. 195 - 230.

²¹ Clarke, op cit.

²² See S.R. Sen op cit., 143 - 155 and Gershon Feder and Roger Slade, op cit., 407 - 428.

comprehensible manner as possible. There were situations where the wording of a question remained a source of problem due to the respondent's unfamiliarity with standard English. Here, the dialect equivalent or other English words had to be supplied, the interviewer taking every precaution to maintain the original and intended meaning of the question.

2.2.2 Informal Discussions

Informal discussions were undertaken to provide valuable data in the reality of the small farmer, for example, the situation of local politics which impacted positively or negatively on RADA's extension efforts. These informal discussions were able to reveal, in a way in which the structured survey was unable to do, the perceptions and socio-economic realities of the farmers. They also provided explanations of farmers' responses towards RADA's extension programme.

Not all the informants of the structured interview were selected as a part of the informal discussions but in each district efforts were made to include a representative of various age groups, sex, and part time farmers, as well as farmers who had active roles in community agricultural groups in the informal discussions. Each respondent was interviewed privately as was the case with the structured interviews. Notes were taken of the comments.

Unlike unobtrusive observation where informants are not aware that they are subjects of an inquiry, the informants of this study were aware of the investigative nature of the conversations. Conversations were used as the means of probing the informant and maintaining some control of the interviews. All efforts were made not to influence the responses. This was achieved by simply repeating the last phrase or sentence of the respondent. At the same time I was careful not to interrupt when silence of the respondent may have meant a moment of reflection.²³

Also critical is the informant's attitude towards the interviewer. This factor may result in answers which are not close to the reality. Although not unique to this method, the possibility of its occurrence is higher due to the lower level of researcher control. In this case had I been an officer of the Ministry of Agriculture responses would most likely be motivated by a perception that

²³ For a discussion of the use of unstructured interviewing and the role of probing in such interviewing read H. Russell Bernard, Research Methods in Cultural Anthropology, (London: Sage Publications, 1988), chap. 9.

financial help or help in form of subsidies could be gained. The farmers came to realise that the research was of an academic nature focusing on an aggregation of individuals rather than on the individual per se. Its focus on the experiences of an aggregation of individuals rather than on the individual per se resulted in a minimisation of this problem.

2.2.3 Personal Observations

Personal observations were also an important means of collecting data. They served additionally to verify certain data collected in the formal and informal interviews. This method of data collection was facilitated by travelling on motorbike with assistant extension officers to areas inaccessible to cars. However on the actual sites whenever the farmer was present I requested that the assistant extension officer be not present in any conversations between the farmers and myself. These observations allowed me to view the physical environment of the farmer. On touring the provision grounds in the absence of the farmer the assistant extension officer pointed out certain problems faced by farmers in the maintenance of his/her provision ground. These tours indicated the extent to which farmers implement on their farms the prescriptions of RADA's extension officers. Observations also allowed me to check the conditions of farms which came under special projects administered by RADA and those farms which came under the regular extension programme of RADA.

2.2.4 Elite Interviews

Persons interviewed included the senior managers at the national level, the agricultural extension officers and assistant agricultural extension officers in the parishes studied, and the Parish Manager and/or the Assistant Parish Manager. Interviews were conducted on two occasions; this does not necessarily mean that each officer was interviewed twice. The first sought two objectives: one, an understanding of the organisation, purpose, and functions of RADA, principally its training component of small farmers; and, two, to identify variables which would be the items to be included in the structured questionnaire. The second set of interviews was conducted on the completion of the data collection of the farmers and were focused on clarifying issues such as the content of training; the choice of training; and the marketing information imparted to farmers.

2.3 Limitations of the Research Methodology

The lack of documentary evidence prevented the researcher from verifying some of the statements of the

respondents. The time allotted for data collection was relatively short. A longer period would have allowed for the selection of a larger sample, for example, the number of districts and the number of farmers interviewed could have been increased.

3. RESEARCH FINDINGS

The research findings are presented in three main categories: one, RADA's delivery of extension service to our sample of farmers; two, levels of response of farmers; three, the factors which influence the farmers' responses. By way of an introduction there is a description of the characteristics of the sample. This is followed by a presentation of data relating to RADA's activities. In relation to the levels of response of farmers, there are three kinds of data, namely, of frequencies of sample responses to the questionnaire, opinions of farmers obtained through informal discussion, and information gained through my personal observation. Regarding the third category of data, that is, factors which influence farmers' responses, this will be presented in the form mainly of cross-tabulations of frequencies against the following factors: age, gender, level of formal education, ownership status, the extent to which farmers engage in non-farm activities, type of farming, farm size, membership in community agricultural groups, format of training. Data derived from cross-tabulations will be supplemented by the findings of informal discussions.

3.1 The Characteristics of the Sample

As indicated earlier the size of our sample was 150 farmers. Of this number 22.7 percent were female, and 77.3 percent, male. In terms of age 28 percent of our sample was in the 60 - 70 years range. Regarding education level, 22.7 percent had no formal education, the majority, 62 percent had primary education. Forty-four percent of the sample are members of a community agricultural group while 56 percent are not affiliated to any community agricultural group.²⁴ As to farm size 62.7 percent of the sample have 1 - 5 acres.²⁵ In terms of land use, 63.3 percent of the sample grew mainly vegetables, 29.3 percent, permanent crops such as cocoa. Livestock was engaged in by 2.7

²⁴ Where there was affiliation, it was mainly to the local Jamaica Agriculture Society.

²⁵ This refers to land in cultivation.

percent of the sample, while 4.7 percent were preoccupied with other means of livelihood such as fishing or an equal combination of vegetable growing and permanent crops. Regarding ownership status, 60.7 percent own their land, 10.7 rent, 15.3 percent lease,²⁶ 1.3 percent occupy illegally, and 12 percent hold otherwise. Of the sample 77.3 percent farm on a full time basis, while 22.7 percent are supplement farm income by non-farm employment. The details of the data are presented in table 3.1.

TABLE 3.1

The Characteristics of the Sample

Variables	Categories	No. of Cases	Percent
Sex	Male	116	77.3
	Female	34	22.7
Age	21 - 26	8	5.3
	27 - 36	23	15.3
	37 - 49	29	19.3
	50 - 59	34	22.7
	60 - 70	42	28.0
	> 70	14	9.3
Type of Farming	Growing of Vegetables	95	63.3
	Permanent Crops	44	29.3
	Livestock Rearing	4	2.7
	Other	7	4.7
Ownership Status	Owner	91	60.7
	Tenant	16	10.7
	Lease	23	15.3
	Capture	2	1.3
	Other	18	12.0

²⁶ The difference between rent and lease is while the former pays for the use of the cultivated land on a monthly basis, the latter pays for long term use usually six months and over.

TABLE 3.1 (contd.)

Variables	Categories	No. of Cases	Percent
Employment Status	Full time	116	77.3
	Part time	34	22.7
Membership in Farmers' Group	Yes	66	44.0
	No	84	56.0
Farm Size (acres)	< 1	34	22.7
	1 - 5	94	62.7
	6 - 10	13	8.7
	11 - 25	8	5.3
	> 25	1	.7

3.2 RADA's Extension Activities

Data presented here falls under three sub-heads: firstly, contents of RADA's training of farmers, its recommendation to farmers about their choice of technology, and marketing information imparted to them; secondly, the circumstances in which these factors have been formulated; thirdly, the means by which they are delivered to farmers. Regarding the latter, there is focus on communication methods, format of delivery, and infrastructural support. These data were obtained almost totally by elite interviews.

3.2.1 Content of Training

RADA provides training to farmers in the areas of crop care including proper use of fertilisers and pesticides, and the application of soil conservation techniques. The training is done by extension officers and their assistants. For the maintenance of permanent tree crops, RADA's extension officers collaborate with extension officers from the commodity boards. These boards assist farmers with the marketing of permanent crops such as cocoa. As to specific content of the training, it was not easy to identify. The main constraint, here, was the scarcity of instructional manuals. RADA has exhibited a preference for on-the-spot oral formulation of training, by which extension officers draw on past knowledge of what they have been taught.

Both 'top-down' and 'bottom up' approaches are evident in the design of training programmes. Although the former is dominant, there appears to be a gradual movement towards the latter. In the management of projects training is determined by a 'top down' approach. One notable exception was the Hillside Agricultural Project: the suggestions of farmers were incorporated in the training programme.²⁷ The project focuses on soil conservation techniques such as terracing, and on the establishment and care of permanent tree crops. In Clarendon a RADA officer was directly responsible for the soil conservation programme for certain areas. His role was to ensure, by further teaching and encouragement, that the farmers practice soil conservation techniques. There is a move towards a bottom - up approach or perhaps more aptly termed a participatory approach as to what should constitute the contents of training for a particular area. The 'bottom-up' approach is facilitated by the establishment of Area Development Committees. These committees allow for the representative participation of farmers in determining the contents of training.

3.2.2 Choice of technology

The motivation for the introduction of new technology in agricultural production are to increase production and productivity, and increase in food exports. The need for sustainable development through careful use of the environmental resources while pursuing the former objectives is another important motivation for the introduction of new technology. Our sample constituted an integral part of a project by RADA to increase the production of yams for export by the application of the mini-sett yam technology. The technology falls under the National Yam Export Development Project and is sponsored by the Government of Jamaica in conjunction with USAID. The selection of this technology had little or no input from the farmers. The mini-sett technology produces small, whole yams that are more uniform in shape, hence their suitability for export. Importantly, they do not need to be treated with chemicals before they are exported and in the cultivation they do not require the large sticks that are used in the traditional growing of yams.²⁸

²⁷ Some of the areas selected in this study were a part of the Hillside Agricultural Project.

²⁸ Inter-American Institute for Cooperation on Agriculture, Growing Mini-Sett Yam in Jamaica: A Manual for Farmers prepared by Maria Protz for IICA in Jamaica, Jamaica, 1983.

3.2.3 Marketing information

The function of RADA in the area of marketing information is threefold: to provide timely information on location, quantity available, and prices of food crops to the buyers of produce; to educate farmers about the relationship between production and marketing; to create contact between the farmer and the buyer.

Marketing information provided by RADA is influenced by whether marketing is for the local market or for export. For the local market focus is mainly on providing information on when to produce specific crops so as to minimise over-production. Little is provided by way of information on markets for domestic produce as in most cases purchases of produce are made directly by higgler. In situations of over-production, however, the extension service does try to assist by locating buyers. Information on pricing for domestic produce is not usually provided as the price is negotiated between the farmer and the higgler. However, according to one extension official, the farmers do not necessarily benefit from the negotiating process. Hence farmers complain about the low prices they are paid for their produce.

Regarding crops grown for export RADA has established links with exporters. These exporters are given timely information on both quantity available and prices. The marketing intelligence is organised on a regional level, in the following manner: data on types of crops grown and the projected quantity which will be available is collected by the extension officers and passed on to the regional marketing officer. This officer then contacts the various exporters. In some areas the exporters purchase directly from the farmers, thus by-passing the marketing facilities provided by RADA.

3.2.4 Delivery of Extension Services

Lectures and discussions are the main methods by which extension officers communicate with farmers. This is preferred to the dissemination of literature. One extension officer, attested that the reason for this is the high level of illiteracy among farmers.²⁹ Communication is done mainly by oral presentations, demonstrations with materials, the use of slides and the use of written materials such as flip charts and brochures.

Two approaches are used, namely, the individual approach and the group approach. A RADA official, in

²⁹ Interview, 22 January 1993.

supporting the group approach referred to the worldwide movement in this direction. Local forces also influenced the use of this approach. The officer stated that the approach was the most appropriate response for dealing with the reduction of extension personnel as a consequence of budgetary cut-backs. For example, in the parish of Clarendon, where fourteen extension officers once served fourteen areas, these were reduced after the budgetary cuts to six extension officers serving six areas.³⁰ As a consequence, these officers had much wider geographical areas to serve. Extension officers drew attention to the fact that reduced extension personnel combined with inadequate transportation make it very difficult to deliver advice and information to farmers on the basis of individual contact. Lack of adequate transportation was cited as one of the main factors which impact negatively on the regular delivery of extension services.³¹ By contrast, the group approach is viewed as a means to offer service to a large number of farmers at one time. The approach has been presented as a complement rather than a replacement for the individual approach and as a means by which RADA can continue to provide extension services to a large clientele.³² The individual approach, therefore, as a means of delivery, though continuing is not able to adequately meet the needs of the majority of the farmers.

Group instruction is organised on the basis of field or training days. Training days were originally held monthly by each extension officer. Now, the regularity has lessened because of escalating costs. On occasions RADA and the commodity boards share in the expenses of conducting training days.

Farms under special projects are monitored on an individual basis. Attempts are made to visit these farms regularly. Farmers are visited by the extension officer or the assistant extension officer on a daily, weekly, or monthly basis. The extension officer and the assistant extension officer follow an itinerary which is prepared on a weekly basis. However, there are times when this itinerary is not followed due to transportation difficulties. An assistant extension officer bemoaned the fact that his itinerary was often not fulfilled due to regular malfunctioning of his motorcycle.

The use of the group approach is facilitated by the

³⁰ Interview, 4 April 1993.

³¹ Interview, 22 January 1993.

³² Interview, 29 January 1993.

existence of active Jamaica Agricultural Society (JAS) branches. This is due to the role of the JAS in organising farmers at the village level. RADA relies on village based organisations such as churches, schools, and JAS branches to inform farmers on time and date of RADA's meetings and the scheduling of training days. In areas where there are inactive JAS branches RADA tries to get them reorganised. One RADA official states, "RADA is trying to restart the JAS branches to act as foot soldiers to bring back farmers into the fold."³³ Community organisations such as the church aid in the dissemination of news to farmers.

3.3 Response of Farmers

Data which follow were obtained from sample responses to the questionnaire, from informal discussion with farmers and from personal observation. Included are data on the effectiveness of RADA's communication system. The delivery system encompasses modes of communication, the communication skills of RADA's extension personnel, the regularity of extension contact, and the format in which knowledge and information is passed on. The relevance of the marketing information, and technology recommended by the Agency for use by farmers, and their opinions concerning what ought to be the main functions of RADA's are presented.

3.3.1 Modes of Communication

The sample of farmers received information from RADA in four main ways: one, oral communication both to groups of farmers using the media of lectures and discussions to identify broad problems, and to individual farmers, using professional advice to address specific problems; two, demonstrations utilising materials; three, demonstrations using written material; and, four, the use of audio-visual. As is illustrated in table 3.2, sixty two percent of respondents stated that oral communication was the mode by which extension officers frequently passed on information to them. By contrast, for table 3.3 thirty four percent demonstrations using materials was most frequently used, and for table 3.4 twelve percent stated frequent use of written material. Demonstrations using audio-visual aids was not a frequent mode of delivering information.

³³ Interview, 4 April 1993.

TABLE 3.2

Regularity of Oral Presentation

Responses	No. of responses	Percent
Frequently	56	61.5
Occasionally	26	28.6
Never	9	9.9
TOTAL	91	100.0

TABLE 3.3

Regularity of demonstration using materials

Responses	No. of responses	Percent
Frequently	31	34.1
Occasionally	31	34.1
Never	29	31.9
TOTAL	91	100.0

TABLE 3.4

Regularity of demonstrations using written material

Responses	No. of responses	Percent
Frequently	11	12.1
Occasionally	13	14.3
Never	67	73.6
TOTAL	91	100.0

TABLE 3.5

Regularity of demonstrations using audio-visual aids

Responses	No. of responses	Percent
Frequently	0	0
Occasionally	15	16.5
Never	76	83.5
TOTAL	91	100.0

Respondents explained the benefits derived from oral communication. It enabled them to grasp complex matter which they hitherto had not fully understood. When done in the form of discussions it facilitated a large measure of exchange between a number of farmers and the extension officer. Occasional use of oral presentation and infrequent contact with extension officers appear to be related. Those who stated that oral presentations have never been used as a means of communication indicated that they had the least contact with their extension officers. The degree of extension contact, therefore, accounted for the differences in response.

The frequent use of demonstrations using materials was the second frequently used communication method. As to the advantages of this technique, farmers felt that it reinforced previously existing knowledge and helped them carry out instructions exactly as taught. It enabled them to correct faulty farming practices and techniques. The mini-sett technique of growing yams, for example, was most easily comprehended in this way. This method was also the most frequently used in the teaching of this technique.

Farmers frequently exposed to demonstrations centred on written material received most of their extension contact on an individual basis. Responding to the specific needs of farmers, extension officers provide them with literature on various farming practices. According to extension officers, written material are used on occasions when there is a need to disseminate a particular type of information, for example, information on the metric system.

The study found that the use of audio-visual aids such as slides was the method of communication least used by extension officers among our sample. Eighty three percent stated that it was never used.

Farmers who do not belong to any organised village agricultural group tend not to receive frequent visits from extension officers. They also stated that they do not receive timely information on RADA's planned activities. In districts where the level of cooperation among farmers is low, informal methods of communication such as farmer to farmer communication cannot be relied on as effective means of communication. Farmers complained that they sometimes hear that a training session was held days or weeks after. The farmers in our survey expressed the view that notices on the scheduling of training days ought to be placed at central locations such as village shops and bars. The lack of communication to farmers who are not members of community groups indicate the need for extension officers to be more conscious of the needs and problems of these

farmers.

3.3.2 Communication Skills of Extension Personnel

Asked to rate the communication skills of extension officers, 49 percent of the sample gave a rating of 'very good'. They considered extension officers to be good teachers who exercised much patience in their use of lectures, discussions, and demonstrations. The communication skills of extension officers was in direct proportion to years of experience. By contrast, only 12.5 percent thought the extension officers were 'poor' or 'very poor' communicators. There was a general perception among this group that sufficient time was not spent in explaining important farming procedures.

TABLE 3.6

Rating of Communication Skills of Extension Officers

Communication Skills	No. of responses	Percent
Very Good	49	55.7
Good	28	31.8
Poor	7	8.0
Very Poor	4	4.5
TOTAL	88	100.0

3.3.3 Regularity of Extension Contact

Responding to the question, how often they saw their extension officers the highest number of responses were in the other category. In one district most of the farmers had not seen their extension officer since the previous year when he organised their participation in the annual Denbigh Agricultural show. Irregular extension visits characterise the category, 'other'.

Asked about their level of satisfaction with the particular arrangement by which they received extension visits, 35.4 percent stated they were satisfied, 64.6 percent were unsatisfied.

TABLE 3.7

Regularity of Extension Officers' Visits

Regularity of Extension visits	No. of responses	Percent
Daily	11	7.3
Weekly	21	14.0
Monthly	24	16.0
Other	94	62.7
TOTAL	150	100.0

The existence of a relationship between extension contact and the initiative of farmers was assumed. To test this, farmers were asked how often they attended training sessions. Sixty two percent of the respondents never attended training sessions, 28 percent attended only sometimes. See table 3.8 for details.

TABLE 3.8

Attendance at Training Sessions

Responses	No. of responses	Percent
Always	8	5.3
Regularly	7	4.7
Sometimes	42	28.0
Never	93	62.0
TOTAL	150	100.0

Of farmers who either attended sometimes or never did, 31.6 percent said that they were too busy to attend, 2.9 percent felt that the quality of training did not serve their needs, 65.4 percent gave other factors such as irregular training sessions. To these farmers, there appeared to be a lack of interest among the leaders in the local JAS branches and RADA's extension officers in organising training days.

Some farmers expressed the view that the inactivity of JAS branches was a contributory factor to training days not being held. The researcher learnt that in one district there is an attempt to restart a defunct JAS branch. In areas where JAS branches are active and training days are

held regularly, some farmers stated a political reason for their non-attendance. They felt that persons in the JAS branch had connections with political parties from which they gained benefits such as free fertiliser, other materials and credit. Among these farmers there is much distrust of the JAS branches, and, there is suspicion of any agency which works through the Society's branches. Hence, training days in which the JAS has had some input are rarely attended by them.

3.3.4 The Format in Which Information and Knowledge is Delivered

The study found that 65.1 percent of the respondents received their extension contact on a one-to-one basis, while 34.9 percent received their extension contact mainly in a group format. The group format is not the predominant form in which extension service is delivered to the farmers.

The usefulness of knowledge received, the retention of what is learnt, and the relevancy of the marketing information received were asked of the respondents who received their extension contact mainly on a one to one basis or in a group format.

TABLE 3.9

Ranking of 'one-to-one' approach: Receipt of Knowledge

Responses	No. of responses	Percent
Very good	40	51.3
Good	23	29.5
Poor	11	14.1
Very poor	4	5.1
TOTAL	78	100.0

TABLE 3.10

Ranking of Group Approach: Receipt of Knowledge

Responses	No. of responses	Percent
Very good	29	50.0
Good	28	48.3
Poor	1	1.7
TOTAL	58	100.0

Regarding the retention of knowledge the farmers expressed the view that each of the format in which extension knowledge is passed has its own advantage and disadvantage in the retention of what is learnt. Commenting on the advantage of the one to one approach the farmers stated that the more personal approach especially when accompanied by demonstration in the field aided in the retention of what is learnt. Regarding the advantage of the group approach, the farmers expressed the view that the discussions and comments of other farmers on problems, solutions, and procedures helped in reinforcing the knowledge which was passed on by the extension officer. Regarding the disadvantage of the one to one approach, the farmers stated that the extension officer did not spend sufficient time with them in instruction. Concerning the group approach in the retention of knowledge a tendency for group discussions to become disorganised was the main disadvantage cited. The ratings of the two approaches are depicted in tables 3.11 and 3.12.

TABLE 3.11

Rating of one-to-one approach:
Retention of Knowledge

Responses	No. of responses	Percent
Very good	24	31.6
Good	34	44.7
Poor	15	19.7
Very poor	3	3.9
TOTAL	76	100.0

TABLE 3.12

**Rating of Group Approach:
Retention of Knowledge**

Responses	No. of responses	Percent
Very good	19	32.8
Good	30	51.7
Poor	8	13.8
Very poor	1	1.7
TOTAL	58	100.0

TABLE 3.13

**Rating of one-to-one approach:
Relevancy of marketing information**

Responses	No. of responses	Percent
Very good	11	14.9
Good	17	23.0
Poor	28	37.8
Very poor	18	24.3
TOTAL	74	100.0

TABLE 3.14

**Rating of group approach:
Relevancy of marketing information**

Responses	No. of responses	Percent
Very good	12	23.1
Good	17	32.7
Poor	14	26.9
Very Poor	9	17.3
TOTAL	52	100.0

Regarding the receipt of relevant information on the marketing of produce, 14.9 percent of the sample rated the one to one approach very good, 24.3 percent rated it very poor (Table 3.13). Twenty three percent of the farmers rated the group approach very good, 17.3 percent rated it very poor. (Table 3.14)

Farmers were asked to rate forms of training in terms of benefits. Benefits refer to their perceptions as to the degree in which they are able to understand and recall what is taught to them, and the usefulness of the knowledge passed on to them in the various forms of training. Of the sample, 27.5 percent of the respondent expressed the view that classroom training was most beneficial, 78.9 percent expressed the view that field training was most beneficial, 75 percent expressed the view that when training was conducted in the classroom and in the field that it was beneficial. The instructions received in the classroom were made clearer when, immediately after, demonstrations were carried out in the field. In the mixed training scenario demonstrations are usually done in demonstration plots. One such plot was used to teach farmers how to use the mini sett technique in growing yams.

3.3.5 Relevance of RADA's Training

In the study an attempt is made to get farmers' opinions on the relevancy of the content of training they receive. The sources of these data were informal discussions with the farmers and observations. The answers to some of the items on the questionnaire indicated some of the views on content of training.

The study found that some of the farmers exposed to extension contact had no problems with the content of training as taught by their extension officers. Others are not pleased with the content of training and as a consequence do not actively seek extension advice.

Farmers who received regular extension contact expressed a satisfaction with what they have been taught. The common view among these farmers was that their extension officers were quite knowledgeable in farming practices and that the knowledge they passed on to them was useful in dealing with problems associated with their farming. Fifty five percent of the sample who received extension contact thought that the knowledge of their extension officer was very good "Sir, when I do what my extension officer tells me to do, I am rewarded with more and better crops for my effort", was a common comment among these farmers. They felt that their extension officers knew exactly what their needs were and was able to respond with appropriate training information. In contrast, only 1.2 percent of the sample rated 'very poor' their extension officers' knowledge of farming practices.

The extension officers were commended for their willingness to listen to problems. Fifty percent of the farmers expressed the view that their extension officer was very good in this area. The farmers felt that this factor,

most of all, enabled the extension officers to plan appropriate training. One farmer confessed that when a new extension officer was assigned to his district he had no trust in his knowledge and capabilities. This extension officer exhibited a high level of patience with him and was willing to both learn from him and to listen to his farming problems. Seeing these qualities, he eventually started to implement some of the officer's advice. The results gained on implementation was quite satisfactory. He now has a high regard for this extension officer and believes that the training he is receiving is quite relevant. In contrast only 9.8 percent of the sample ranked their extension officer 'very poor' in terms of his willingness to deal with their problems.

Farmers who did not actively seek extension advice expressed the view that they can do a better job than "those agriculture boys who know nothing about farming." These farmers referred to their years of experience and stated that the way in which some extension farmers communicated to them was akin to a contempt for their experience and knowledge. They prefer not to be insulted in this manner, especially, since they already are "quite knowledgeable in agricultural matters". These comments reveal a negative attitude towards RADA's content of training.

Some farmers stated as their reason for not seeking extension services, the many times in the past when promises to them have not been fulfilled. These farmers while conceding that it was not necessarily an extension service practitioner who made unfulfilled promises to them, stated that the many occasions of unfulfilled promises have led them to be cynical towards all agricultural efforts which emanate from official sources such as the Ministry of Agriculture.

Other farmers stated their willingness to listen to extension advice but noted that they carefully selected those aspects of knowledge and information passed on to them by the extension officers which they thought useful and rejected others which they perceived not to be in their interest or which did not correspond to their value system. This has implications for the choice of technology.

A majority of farmers expressed the view that the training, though useful, was not fully implemented because of a lack of material inputs and inadequate labour. When asked to comment on the factors which were major to their inability to implement training instructions, the factors cited were economical rather than related to any extension variable. Eighty nine percent of the sample stated that the lack of material inputs was a major reason in not

implementing training suggestions; 82.5 percent stated the unavailability of credit, 78.9 percent, inadequate labour. In contrast, only 3.4 percent stated that the reason was extension officers not sufficiently explaining instructions. Those farmers who knew that RADA's mission did not include provision of material inputs positively rated RADA's content of training. However, provision of such inputs to farms under special projects created confusion about the training role of RADA. These farmers were ignorant of the status of farms who fell under special projects and of RADA's function in managing projects sponsored by other agencies.

In situations where material inputs are provided to project farmers who are members of the local Jamaica Agricultural Society (JAS) branches there is a perception that the receiving of these benefits is politically motivated. These farmers expressed the view that RADA has not acted neutrally in the giving of material inputs. In districts where the political persuasion of farmers belonging to the JAS branches was well known, this factor was often cited. The JAS branches in these districts and RADA have therefore become associated with the practice of clientelism. As a consequence, these farmers tend not to attend JAS meetings and show little interest in the activities of RADA.

In certain districts of Clarendon where the mini-sett technique of growing yams is being promoted by RADA and where farmers receive training in the technique it was observed that many farms not only still retained the old method of growing yams but on other farms the evidence of the use of this technique was absent. One farmer stated that he is accustomed to growing his big yams. Although he, along with others, acknowledged the superior economic benefits of growing the smaller sized yams, the view was expressed that success in growing yams was always measured in terms of the large size of the yams produced. The new technology therefore ran counter to their traditional view of success, hence one possible reason for its slow acceptance. Some farmers stated financial constraints as the major reason for not utilising the mini-sett technique. Data based on the questionnaire show that of the sample of respondents who were taught the technique 40.9 percent used the technique while 59.1 percent did not use the technique.

3.4 Group Membership, RADA Activities, and Farmer Response.

The impact of RADA appears to have been more favourable to farmers who are members of local agricultural groups than those who are not members. The former were in contact with extension personnel more frequently, attended

training sessions more regularly, and, therefore, had a more favourable view of the competence and professionalism of the Agency's personnel.

In terms of instructional visits, group members, in relation to 'non-group' counterparts receive more visits, however spaced. The category 'other' refers to an irregular pattern of visits or no visit from extension officers. The more frequent responses in this category came from non-group members. See table 3.15 for details. The number of cells with expected frequency less than five is not more than 20%. The chi-square test in this case can be applied. In other cases, where the conditions for the use of the chi-square do not hold the discussion will be based on general trends³⁴. The chi-square value of 32.7 with a significant level that is less than .05 indicate that there is a relationship between group membership and the regularity of extension visits. The lambda value of .39 indicates a weak correlation. Hence predictions on the regularity of extension visits based on a knowledge of the farmers' group membership status would be weak.

TABLE 3.15

Regularity of visits from extension officers

Responses	Member	Non-Member
Daily	10.6	4.8
Weekly	21.2	8.3
Monthly	30.3	4.8
Other	37.9	82.1
TOTAL	100.0	100.0

Chi-Square Significance Lambda
32.72517 .0 .39394

Of the 'Group' farmers in the sample, 12.1 percent always attended training sessions, 9.1 percent attended regularly, while 51.5 percent attended sometimes, and 27.3 percent never did. Except for those who never attended, their rate of attendance was higher than the proportion of farmers who were not members of groups. There was no response in the category 'always' for 'non-group' farmers.

³⁴ For a discussion on the use of the chi-square statistics and the data requirements for its application see Marija J. Norusis, The SPSS Guide to Data Analysis, SPSS Inc, USA, 1988.

One percent attended regularly, 9.5 percent, sometimes, and, 89.3 percent, never.

Regarding help in situations of emergency, extension officers were available to 76.2 percent of 'group' farmers and to 50.6 percent 'non-group'. Emergency assistance was not available to 23.8 percent of the former, and 49.4 percent of the latter. The chi-square value of 9.81 is significant. Hence, there is a relationship between group membership and the response concerning the availability of the extension officer in an emergency. The lambda value of .11 indicates a weak correlation.

Information not new to farmers such as soil conservation, and crop care, are passed on mainly through oral methods. This information is usually to reinforce a practice in which farmers may have become negligent; it is a situation where the farmers have knowledge of the details of a process but due to financial constraints resort to incorrect procedures. Lectures and/or demonstrations are held to correct these procedures.³⁵

A relatively new practice requiring detailed information would necessitate the giving of written material or the showing of slides. However, in this case extension officers take into account the different educational level of farmers. Personal knowledge of farmer education determine, therefore, the method(s) of communication selected. If the farmer is not able to read, demonstrations, lectures, and slides are utilised. The latter, however, are rarely used. This may be due to the lack of audio-visual equipment or the lack of electricity in certain districts.

Regarding the regularity of method of communication, 82.4 percent of 'group' farmers reported frequent use of oral presentations, 35 percent of 'non-group' farmers reported frequent use of oral presentation. Of 'group' 13.7 percent stated the occasional use of oral presentation, 47.5 percent of 'non-group' reported occasional use of oral presentation. Four percent of 'group' stated that oral presentations were never used, 17.5 percent of non-group members stated that oral

³⁵ Some of the extension officers stated in the interviews the sense of frustration they feel when they cannot provide material input in the maintenance of farmers' crops. All the farming advice, they state, seem to be in vain when the farmer is faced with financial constraints. To these extension officers RADA's de-emphasis on the provision of material inputs to farmers is a policy which may need to be carefully re-examined.

presentations were never used. The chi-square value of 21.29 is significant. The test for significance can be applied as only one of the six cells is less than five. There is a lambda value of .42 indicating that the error in predicting the regularity of oral presentations based on a knowledge of the farmers' group status is reduced by 42 percent.

Regarding demonstrations using materials, of 'group' farmers 44 percent stated its frequent use, 'non-group', 22 percent, 28 percent of 'group', 41.5 percent 'non-group', occasional use, and 28 percent of 'group', 36.6 percent of 'non-group', never used. Of the sample 19.6 percent of 'group' farmers and 2.5 percent of 'non-group' stated the frequent use of written materials in demonstrations, 23.5 percent 'group' and 2.5 percent 'non-group', occasional use, and 56.9 percent 'group' 95.0 percent 'non-group', never used. The chi-square value of 16.7 is significant. The lambda value of .22 indicates that the prediction of the regularity of the use of written material knowing the group status of the farmers would be weak.

Farmers were asked to rate their extension officers in terms of the provision of marketing information. 'Group' farmers gave consistently higher ratings than 'non-group' farmers. The chi-square value of 15.4 shows that the relationship between the group status of the farmers and their ratings of their extension officers provision of marketing information is statistically significant. The error of prediction is reduced by 30 percent as is indicated by the lambda value. See table 3.16 for details.

Twenty three percent of 'group' farmers and 37 percent of 'non-members' implemented all suggestions of extension officers while 77.4 percent 'group' and 63.0 percent 'non-group' did not implement suggestions. The chi-square value of 1.20 indicates the non-relationship between status of membership and the implementation of suggestions.

Of 'group' farmers, 40 percent made use of the minisett technique of growing yams, 50 percent of 'non-group' did. Sixty percent of 'group' farmers, and 50 percent 'non-group', reported not making use of the technique. The conditions necessary for carrying out the chi-square test do not apply. However, the data indicate that there is no relationship between membership status and the use of technique. The percentages of 'non-member' in this case represent the view of two farmers and therefore must be interpreted with caution.

TABLE 3.16

The provision of marketing information

Responses	Member	Non-Member
Very good	38.3	10.3
Good	25.5	15.4
Poor	25.5	35.9
Very poor	10.6	38.5
TOTAL	100.0	100.0

N = 47

N = 39

Chi-Square Significance Lambda
 15.45247 .0015 .30769

3.5 Training Format, RADA Action, and Farmer Response

Farmers who are trained mainly on a one to one basis receive more daily and weekly visits from extension officers than those who are trained mainly in the group format. However, they experience more irregular pattern of visits. Generally, though, their response to RADA's activities was more favourable than those are trained mainly in 'group format'. One notable exception was the response to RADA's marketing activity. Here, the response of 'group format' farmers was more favourable.

Regarding the regularity of oral presentation, 50.8 of farmers who receive their training mainly on a one to one basis stated that it was frequently used, while 83.3 percent of those who were trained mainly in group format stated its frequent use. Of those who specified occasional use, 36.1 percent were 'one to one' trained, 13.3 percent, 'group'. Thirteen percent, 'one-to-one' and 3.3 percent stated that oral presentation was never used. The chi-square value of 9.03 is significant indicating that there is a relationship between format of training and the regularity of oral presentation.

In terms of the provision of marketing information, of those who receive training on a one to one basis 16.9 percent ranked extension officers 'very good', 18.6 percent, 'good', 37.3 percent, 'poor' and 27.1 percent 'very poor'. Of the group trained, 46.2 percent ranked the officers, 'very good', 26.9 percent, 'good', 15.4 percent, 'poor', and 11.5 percent, 'very poor'. The chi-square value of 11.3 indicates a relationship between format of training and views on extension officers' performance regarding the provision of marketing information.

In respect of both implementation of suggestions and use of techniques proposed, the response of 'group format' farmers was less favourable than that of those related to on a one to one basis. In terms of implementation of suggestions 39.6 percent of the latter appear to have implemented all suggestions made by their extension officers, while 9.7 percent only of those who receive training in group format did so. Among those who did not implement suggestions, 60.4 percent receive one to one training, 90.3 percent, group training. The chi-square value 6.96 indicates a relationship between format of training and the implementation of suggestions.

TABLE 3.17

**Ranking of extension officers:
The provision of marketing information**

Responses	One-to-One	Group
Very good	16.9	46.2
Good	18.6	26.9
Poor	37.3	15.4
Very poor	27.1	11.5
TOTAL	100.0	100.0

N = 59

N = 26

Chi-Square	Significance	Lambda
11.32170	.0101	.07692

As for adoption of technique, 60 percent of those who receive their training on a one to one basis, and 35.3 percent of those in groups implemented all the suggestions of their extension officers. Forty percent, 'one to one' trained farmers and 64.7 percent, 'group' did not. The conditions for carrying out a chi-square test do not apply in this case. Hence, we cannot test for a relationship.

3.6 Ownership Status, Extension Activity, and Farmer Response

A relationship was sought between the ownership status of respondents, on one hand, and response to RADA activities. In terms of extension visits owners received the most visits. They were also more favourable of the marketing information provided by RADA.

Relating to the regularity of visits from extension

officers, owners received overall the most visits. The category 'other' received more daily and weekly visits. This category refers to tenurial arrangements which could not be clearly categorised. One example was those who were given plots to cultivate in exchange for a share of the profits. For details, see table 3.18.

TABLE 3.18

Regularity of visits from extension officers

Response	Owner	Tenant	Lease	Squatt -ing	Other
Daily	6.6		8.7		16.7
Weekly	16.5	6.3	8.7		16.7
Monthly	24.2	12.5			
Other	52.7	81.3	82.6	100.0	66.6
TOTAL	100.0	100.0	100.0	100.0	100.0

N = 91 N = 16 N = 23 N = 2 N = 18

TABLE 3.19

Provision of marketing information

Response	Owner	Tenant	Lease	Squatt -ing	Other
Very good	29.3	20.0	15.4		22.2
good	22.4	20.0	7.7		33.3
poor	29.3		38.5		33.3
very poor	19.0	60.0	38.5	100.0	11.2
TOTAL	100.0	100.0	100.0	100.0	100.0

N = 58 N = 5 N = 13 N = 1 N = 9

Regarding the use of technique, 33 percent of owners stated that they made use of the technique taught to them, 66.7 percent did not use the technique. The other responses are 100 percent but these in fact represent the views of single individuals.

On the matter of providing marketing information, 29.3 percent of the owners gave a ranking of 'very good' to their extension officers, an equal percentage gave a

ranking of 'poor'. Sixty percent of tenants ranked their extension officers, 'very poor'. Details of the data are presented in table 3.19.

3.7 Type of Farming, Extension Activity, and Farmer Response

A relationship was sought between type of farming and farmer response to extension activity. In this case, the focus was on visits from extension officers and the implementation of suggestions. The data show that farmers of tree crops received more visits from RADA's extension officers, however they were less inclined to implement suggestions than their vegetable growing counterpart.

Regarding the regularity of visits from extension officers, 12.6 percent of vegetable growing farmers received visits on a monthly basis, 29.5 percent of farmers who specialised in the growing of tree crops received weekly visits from their extension officers.

TABLE 3.20

Regularity of visits from extension officers

Responses	Vegetable	Tree crops	Livestock rearing	Other
Daily	7.4	6.8	25.0	
Weekly	7.4	29.5		14.3
Monthly	12.6	25.0		14.3
Other	72.6	38.7	75.0	71.4
TOTAL	100.0	100.0	100.0	100.0

Of vegetable growers 31 percent implemented all suggestions of extension officers, and of growers of tree crops, 21.9 percent implemented. Sixty nine percent of vegetable growers and 78 percent permanent crop growers did not implement suggestions.

3.8 Size of Farm, Extension Activity, and Farmer Response

Here, we seek to determine whether there is any relationship between regularity of extension visits, implementation of suggestions and farm size.

Farmers with 6 -10 acres, receive more weekly and monthly visits and those with 11 - 25 acres receive more daily and weekly visits than farmers with smaller acreages.

Of those under one acre, 11.8 percent receive daily visits, 8.8 percent, weekly, 8.8 percent, monthly, and 70.6 percent, irregular visits. The latter can range from a visit every two months to a year. Six percent of farmers, 1 - 5 acres receive daily visits, 13.8 percent, weekly, 16 percent, monthly, and 63.8 percent, irregular visits. Farmers of 6 - 10 acres, no daily visits, 15.4 percent, weekly, 46.2 percent, monthly, and 38.5 percent, irregular. Of those with 11 - 25 acres in cultivation, 12.5 percent, daily visits, 37.5 percent, weekly visits, no monthly visits, and 38.5 percent, irregular.

The data do not indicate a relationship between size of farm and farmers implementation of suggestions. Of those who implemented suggestions the distribution was as follows: Under one acre, 38.5 percent, 1 to 5 acres, 23.1 percent, 6 to 10 acres, 30 percent, and 11 to 25 acres, 40 percent. Under one acre, 61.5 percent, 1 to 5 acres, 76.9 percent, 6 to 10 acres, 70 percent, and 11 to 25 acres, 60 percent did not implement.

3.9 Sex and Age, Extension Contact, and Farmer Response

There was a certain uniformity between male and female farmers in their response to RADA's extension activity. The same uniformity occurs across ages. Where there are differences, they are not significant. An example, in the implementation of suggestions, 27.6 percent males, and 27.3 percent females implemented. The similarity continues as 72.4 percent males and 72.7 percent females did not. In all of the age categories, 21- 26, 27 - 36, 37 - 49, 50 - 59, the proportions who implemented suggestions were very similar.

4. DISCUSSION OF THE FINDINGS

The focus, here, will be on the content of RADA's training, its system of service delivery, methods of communication, choice of technology, the provision of marketing information and the responses of the farmers to each of these activities. In attempting to explain the responses, the personal characteristics of the farmers will be critical.

4.1 Content of Training

As was noted, the specific content of training was not easily identifiable due to the scarcity of printed material. Instruction is done mainly orally. A heavy burden lies on extension officers. The data suggest that

some extension officers seek the advice of farmers in designing training programmes. By this means farmers get an opportunity to participate in designing their training programme. This participatory element, however, depends on the personality of the extension officer. An extension officer who seeks advice from farmers is more likely to design a training programme appropriate to their needs.

Quite apart from farmers' participation in the formulation of training programmes, one has to consider the extent to which the programme is informed by research. Research would greatly facilitate the provision of technical support for extension officers. Technical support for critical areas such as crop care, farm management, and soil conservation seem to be lacking. In terms of farms under special projects, collaboration with local agencies and international organisations, and technical support for research, are stronger. The latter is lacking due to poor coordination between various experts in agriculture, on one hand, and, extension officers, on the other. The factors contributing to this are not clear. J.R. Deep Ford suggests that lack of clear goals may contribute to loose coordination between extension divisions and other agricultural entities³⁶.

The findings reveal that cynicism due to past failures, perceived notions of clientelism, and economic factors play a greater role in determining acceptance and implementation of RADA's training programme than the actual content of training. In analysing farmers reluctance to new practices in a hillside agricultural project, Elsie Lefranc found these factors to be significant³⁷. RADA's policy of not providing material inputs means that non-implementation will continue to be a problem. However, there is a greater role, that RADA can play in tackling the problems of cynism and perceived notions of clientelism. The ways in which this can be achieved will be discussed in the recommendations.

Extension variables such as the format in which instruction takes place also influenced farmers responses to content of training. Farmers who are members of groups expressed a greater satisfaction with what they have been

³⁶ See J.R. Deep Ford, Small Farmer Development in the Commonwealth Caribbean, in Report of the Commonwealth Workshop on Policies and Programmes for Small Farmer Development in the Caribbean, St. Georges, Grenada, 21 - 25 April 1986.

³⁷E. Lefranc, Small hillside farmers in Jamaica: a social analysis. Prepared for USAID/Jamaica, 1986.

taught than farmers who were not members of groups. The best explanation for this may be that in the groups there is a greater level of interaction between farmers and extension officers and between farmers and their peers.

What seemed contradictory was the findings on content of training for those trained mainly on a one to one basis. They expressed greater satisfaction with content of training than their mainly trained 'group' counterpart. These farmers attended group meetings and in addition received more frequent visits from their extension officers. One possible explanation is that knowledge passed on in group format is reinforced in the one to one situation.

4.2 RADA's Communication System.

4.2.1 Regularity of Extension Officers' Visits

Farmers who are members of community agricultural groups are in contact with extension personnel more frequently than are non-community members. This indicates a closer familiarity between extension officers and members of agricultural community groups. However, this is not to be interpreted to mean that the group format of extension delivery was dominant to that of the one to one approach in terms of the regularity of extension visits.

The findings show that farmers who receive training mainly on a one to one basis received proportionately more daily and weekly visits than their 'group' trained counterparts. In this case, although those who are trained mainly on a 'one to one' basis were also members of agricultural groups, they seem to have developed a closer relationship with extension officers and assistant extension officers. Some of these farmers commented on the good relationship which they had with their extension officers. One of the factors which appears to have contributed to this was the status of these farmers in their communities. Almost all occupied prominent positions in the JAS branches, and some were leaders in other community groups.

It may well be that RADA intends for these farmers to assist in passing on extension advice to other farmers; hence the regularity of extension visits. Another reason is their potential role in strengthening the JAS branches. This would be desirable to RADA as these branches are the main means by which the group approach of extension delivery is effected. The regular visits to these farmers appear to be one of the principal ways by which RADA hopes

to organise farmers into groups³⁸.

Farmers who are owners of plots under cultivation received more visits from extension officers than farmers of other tenurial arrangements. It may well be that these farmers take more of an active interest in obtaining extension advice. The underlying notion, here, is that they have more 'secure' forms of tenure relative to other farmers and, hence, on the whole are more entrepreneurial in spirit. This notion, however, has been debated. Citing the view of other authors on this matter, LeFranc states:

"...there is not a simple nor automatic relationship between tenure on the one hand, and land utilization, production, productivity, and entrepreneurship on the other...Generally speaking, there is little evidence that inherited or tenanted land is less likely to be fully utilised. On the contrary, rented lands are often more intensely cultivated."³⁹

This explanation is therefore not supported by the implications of other studies. Because rented lands tend to be more intensively cultivated it would follow that these farmers would seek to obtain more visits from their extension officers. An explanation may lie in extension officers' perception towards owners who cultivate relatively large acreages. The frequency of extension visits to large farms (6 - 25 acres) is indicative. Unlike other farm sizes, these represented farms which were exclusively owned. This would account for the proportionately higher incidence of visits to owners.

Farmers in the age ranges, thirty-seven through forty-nine, and fifty through fifty-nine received more visits from extension officers. Males received more visits than females. Growers of tree crops received more visits than growers of vegetables. And those involved in farming on a full time basis received more visits. From these factors we obtain a profile of the farmer who benefits proportionately more in terms of visits from extension officers.

³⁸ For a discussion on the benefits of group organisation and the extent to which extension systems may help to bring about group action see David Dolly, "Extension for Small Farmer Development in the Caribbean" in Report of the Commonwealth Workshop on Policies and Programmes for Small Farmer Development in the Caribbean. St. Georges, Grenada, 21 - 25 April 1986.

³⁹ Elsie Lefranc, Small Hillside Farmers in Jamaica: A Social Analysis. Prepared for USAID/Jamaica, 1986.

This farmer is a middle to upper aged male, one who owns a relatively large farm, belongs to an agricultural group, and cultivates mainly tree crops.⁴⁰

4.2.2 Methods of Communication

The favourable comments of farmers concerning the communication skills of extension officers indicate that they are able to understand complex and detailed information passed on by some extension officers. More experienced extension officers appear to have been able to communicate more effectively, across all methods, than are extension officers who are not as experienced.

Since 1992 RADA has been operating on reduced staff. This appears to have had an impact on the methods of communication chosen. The number of training days have been reduced. Hence, the main method used at training days, namely, demonstrations, have also been reduced. To solve the constraints of staff cut-back RADA has turned to the group approach. This approach lends itself more easily to use of lectures as a more frequent method of communication. The preferred choice of farmers is the training or field day. If the group approach is to accomplish its goals as the development of the small farmers, it will have to incorporate more training days into the lives of the farmers.

4.3 Farmers' Use of Technology

The examination of a particular technology for the growing of yams constituted a small part of our research. Hence, generalisations are not attempted. The relative small size also negates the use of comparisons with various farmer characteristics. Nevertheless, the study provided an insight of the process by which RADA selects and 'market' the technology to farmers.

The motivation for selecting new technology is not located per se within RADA but by the concerns of national policy as articulated by the government. International sponsored projects seem to be the major initiators of new technology. In this scenario, RADA appears to be managers of projects sponsored technology with little input in the

A study by LeFranc found a relationship between age and type of farming. Younger farmers had a greater interest in the quick returns of the annual cash crops while the older ones were comfortable with the rhythm of tree cropping. See E. LeFranc, Small Hillside Farmers in Jamaica: A Social Analysis. Prepared for USAID/Jamaica 1986.

actual formulation of new technology.

The top-down approach is evident in the mini-sett technology of growing yams. Little or no advice was sought from the farmers as to whether or not the technique was appropriate. The relative success of the technology in other countries seems to have been the main criterion for its promotion in Jamaica. Farmers' input appears to have been brought in at a stage when the selection of the technology was already a foregone conclusion. The extent to which this may have played a part in some of the farmers not utilising the technique has not been established. However, this factor ought to be borne in mind when considering the acceptability of new technology by farmers.

In our sample, although farmers exposed to the technique demonstrated some enthusiasm for it they had not made use of the technique on their farms. There were farmers who, while acknowledging the economic benefits of growing the smaller variety, continued in the old method of growing yams. This may lead to an interpretation that conservatism and traditionalism are the main factors for some of these farmers not utilising the technique. The literature suggest, however, that one has to look to additional factors to account for the non-adoption of technology by farmers. Regarding this, Lefranc stated that based on empirical work economic factors are more important than conservatism and traditionalism in farmers' willingness to adopt new technologies⁴¹. Hyacinth Chin-Sue and Michael Ramsay imply that assistance in the form of supply from nurseries which would lessen the capital investment by farmers would result in more adoption of the mini-sett technology⁴².

The view put forward by these writers is one which conceptualises the farmer as a rational economic agent. This concept also seems to underlie RADA's approach to

⁴¹ E. Lefranc, Small Hillside Farmers in Jamaica: A Social Analysis. Prepared for USAID/Jamaica, 1986, p. 48. For a discussion of the rational approach of traditional farmers see Theodore W. Schultz, Transforming Traditional Agriculture, The University of Chicago Press, Chicago, 1983.

⁴² Hyacinth Chin-Sue & Michael Ramsay, "Some Responses of Small Farmers to Mini-sett Yam Production", Proceedings of the Second Annual Conference of JSAS in JAGRIST, the Bulletin of the Jamaican Society for Agricultural Sciences (JSAS), Volume 4, April 1992, pp. 107 - 110.

farmers in regards to the acceptance of the mini-sett technology. The promotion of the technology is done by referring to its success in terms of increased production and increased monetary returns to the growers. Some help is provided in terms of nurseries. The success, according to one of the extension officers if consistent will be convincing to those who are in doubt.

4.4 Marketing Information

The evidence suggests that by default RADA operates a dichotomous marketing service to farmers. Farmers who produce for export have a more sophisticated level of marketing intelligence. RADA's marketing intelligence for the local market is not as developed. The local marketing of produce has long been dominated by higgler dating back to the days of slavery. Some of the farmers, mainly women, are themselves involved in this profession. The marketing system based on higglering has not been able to deal with problems of glut due to over-production. In an effort to deal with this the Agricultural Marketing Corporation (AMC) was established to act as a middleman between the farmers and the consumer/retailer. The marketing of local produce developed as a culture in which farmers failed to see the connection between production and marketing. With the demise of the AMC the farmers have not been able to rid themselves of a marketing culture which involved an agency purchasing all their produce in a period of glut.

RADA realises the dilemma as is evident in interviews conducted with this researcher. Some effort is applied to give farmers an understanding of the link between production and marketing. In situations where glut is going to arise due to over-production extension officers point this 'danger' out to farmers and encourage them to get involved in the growing of alternative crops. However farmers do not always heed the advice of the extension officers due to the attractiveness of monetary returns based on the current heavy demand for the particular crop grown. When the glut occurs the farmer yearns for the marketing model based on the AMC strategy. It appears that in such frustrating situations RADA's officials have chosen to focus their energies on providing marketing information for export crops. Rather than a retreat what is required is more focus on how to implement an effective marketing programme based on local participation.

5. CONCLUSIONS

The purpose of this study is to assess RADA's delivery of knowledge and information to farmers. In carrying out this exercise the research focused on the following: content of training, that is, its formulation and farmers' responses to it, the communication methods and format of training used by extension officers, the frequency of extension contact, the formulation of technology, its transfer to farmers, and their responses to it, the provision of marketing information. The study sought to identify factors which influenced farmers' influences.

5.1 Summary of Findings

The study found that some farmers were not receiving extension contact. These had no knowledge of their extension officers or of the extension activities in their communities. These farmers complained of the lack of extension advice and expressed the view that RADA's communication system needed improvement.

Others chose not to receive extension advice. This category included the following: farmers who thought that they had as much knowledge as any extension officer, others who were cynical to the extension service due to past unfulfilled promises made by agricultural officials, those who thought that RADA practiced favouritism and clientelism. This perception is reinforced by the knowledge that certain members of the JAS whose political allegiance was known received more benefits in terms of material inputs than the other farmers.

There were other farmers who received visits from their extension officers on an irregular basis. They complained of this and also of the irregularity of training sessions. They offered as explanation for this lack of extension contact the inactivity of their local JAS branches. Extension officers and managers cited this factor as one which hindered the effective delivery of extension services in certain districts.

The majority of farmers who received extension contact on a regular basis expressed satisfaction with the content of training, and methods of communication used. They showed a preference for field training rather than classroom training. Most of these farmers were members of a community agricultural group. Statistical tests showed a significant relationship between farmers' group status and RADA's activities. This relationship was also found to influence farmers' opinions on RADA's extension services.

The variable, implementation of extension officers' recommendations, was a proxy for acceptance of extension advice. The study found that non-implementation was not influenced by extension variables such as communication skills of extension advice but to economic variables such as lack of credit, material inputs, and non-availability of labour.

This was found to be the case also for the acceptance of technology. The proxy, use of technology was used to determine acceptance of the mini-sett technology of yam growing. The findings confirmed the concept of the economic rational farmer as held by Theodore Schultz and Elsie Lefranc. A majority of farmers stated economic constraints as the main reason for the non-adoption of the mini-sett technique. There were a few, however, who gave reasons which were traditional rather than economic.

Farmers of produce for the local market were not pleased with the level of marketing information provided to them by RADA. The common view was that RADA ought to assist in the marketing of produce. The role of providing marketing **information** was not fully understood. Extension officers' efforts at educating farmers of the relationship between production and marketing has not had the desired impact which RADA had hoped for. The marketing information provided to farmers of produce for export is more effective due to the following: established links with exporters, a reliable marketing intelligence which provide timely information on prices, availability of produce, regions in which to locate adequate supplies of produce. Here, a relationship between group status and farmers' satisfaction with marketing information received was statistically significant.

5.2 Recommendations

1. There is a need to include in the extension programme the majority of farmers who are at present not receiving any extension contact. In order to achieve this, RADA has to analyse the factors which influence non-extension contact. This study has uncovered some reasons. Concerning the category of farmers who are desirous of extension contact, communication regarding times and dates of meetings has to be strengthened. An evaluation of how farmers are informed of training sessions, times and dates of meetings have to be conducted for each district. There may well be the need for notices of meetings to be placed in strategic locations rather than sent to the churches as is traditionally done.

2. In order to avoid the development of cynicism among farmers, RADA has to communicate their role as agents of advice rather than providers of inputs. When this is understood, farmers will assess RADA not on its ability in providing material inputs but on its stated objectives. Extension officers despite their frustrations regarding farmers' inability to implement recommendations due to lack of material inputs must be careful not to promise what they cannot deliver. These promises could send confusing signals to farmers.
3. Related to the aforementioned is the need for RADA to communicate their role in managing projects sponsored by other agencies. In some of these projects farmers receive material inputs. These are given from the budgets of the various agencies and not from RADA's budget. In many instances the inputs are distributed by RADA. To farmers who are ignorant of this role of the agency this is an example of favouritism and political clientelism. This problem can be lessened by more communication. The sources of the material inputs must be made known to the farming community.
3. Greater reliance on the group approach as the main means of delivery of extension service necessitates the strengthening of the JAS branches. This involves ensuring that the leadership is of a certain moral standard, one in which the community has trust. In the absence of capable community leadership, RADA's officers may need to take a leading role, until such time when capable leaders emerge from the community.
4. The one to one approach ought not be used solely for passing on knowledge and information but to elicit the help of farmers in disseminating extension advice and information on dates and times of training sessions to others.
5. Extension officers need to have access to more up-to-date training manuals and extension kits. There is need also for more in-service training for extension officers. Such training should focus on communication methods and management skills. These skills will be needed for the management and coordination of extension activities in the local JAS branches.

5.3 Implications for Further Studies

This study utilised cross-classification tables and the chi-square statistics to test relationships between two variables. Further studies might make use of a logit model of analysis. It would be appropriate for the following

reasons: the dependent variables of this study were dichotomous in nature, the variables were nominal and ordinal in nature. The dependent variable could then be expressed as a function of a number of categorical independent variables. Further studies could focus on evaluating RADA in terms of its impact on farmer productivity and efficiency. This approach would need to utilise econometric techniques in its analysis.

A study could examine in detail the various models of developing technology for agriculture in Jamaica. Two models that could be compared as to the formulation and dissemination of technology are the on-farm adaptive research and the station based research. The extent to which both can have an impact on the achievement of RADA's goals could be analysed.

5.4 Implications for Policy

The present marketing arrangement by which RADA assists farmers of domestic produce will need to be looked at. Policy-makers could possibly look at local cooperative ventures in marketing. Various self-help models could be examined. An appropriate model may greatly assist the Agency in carrying out not only its marketing functions but others as well. The stress on group delivery of extension service indicates that RADA might well be considering these models of self help. These might well be critical, given the difficulties which the agency faces from the present economic climate.

The training presently given to extension officers may need to be multi-disciplinary in nature. The varied tasks which they are required to perform may necessitate this approach.

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APPENDIX 1

THE QUESTIONNAIRE

CONFIDENTIAL

A SURVEY ON FARMERS' ATTITUDE AND OPINIONS ON THE EXTENSION SERVICE PROVIDED BY THE RURAL AGRICULTURAL DEVELOPMENT AUTHORITY (RADA).

Conducted by Selvyn Gilbert, Graduate student, Consortium Graduate School of the Social Sciences, UWI, Mona.

My name is Selvyn Gilbert. I am from the Consortium Graduate School of the Social Sciences. As a part of my research programme, I am assessing the Rural Agricultural Development Authority's delivery of knowledge and information to farmers. I am interested in getting your opinions and attitudes on the extension service provided by RADA. The information you provide is vital to this research exercise. I am therefore looking forward to your cooperation.

INTERVIEWER -----

INTERVIEW # -----

PARISH -----

EXTENSION AREA -----

DISTRICT -----

1. TO BEGIN WITH, I WOULD LIKE TO KNOW HOW LONG YOU HAVE BEEN INVOLVED IN FARMING?
-----YEARS

2. WERE ANY OF YOUR PARENTS INVOLVED IN FARMING?
(1) YES
(2) NO

3. OF THE FOLLOWING ALTERNATIVES, WHICH ONE WOULD YOU SAY BEST DESCRIBED YOUR DECISION TO BECOME A FARMER?

- (1) DESIRE FOR SELF-EMPLOYMENT
- (2) ECONOMIC GAIN
- (3) LOVE FOR FARMING
- (4) OTHER, PLEASE SPECIFY

4. WOULD YOU ENCOURAGE A YOUNG PERSON TO ENTER A CAREER IN AGRICULTURE?

- (1) YES
- (2) NO

5. IF NO, LIST ONE FACTOR WHICH IN YOUR OPINION WOULD MAKE AGRICULTURE AN UNDESIRABLE CAREER CHOICE FOR A YOUNG PERSON _____

NOW I WOULD LIKE TO ASK YOU SOME QUESTIONS ABOUT YOUR RELATIONSHIP WITH OTHER FARMERS.

6. DO YOU BELONG TO THE JAS OR OTHER FARMERS' GROUPS?

- (1) YES
- (2) NO

7. HAVE YOU FOUND MEMBERSHIP IN THESE GROUPS HELPFUL TO YOU AS A FARMER?

- (1) YES
- (2) NO

8. IF YES, INDICATE WHICH OF THE FOLLOWING KINDS OF HELP YOU CONSIDER TO BE MAJOR, MINOR, OR NOT IMPORTANT.

	MAJOR	MINOR	NOT IMPORTANT
1. THE PROVISION OF MATERIAL INPUT	1	2	3
2. THE PROVISION OF CREDIT	1	2	3
3. MANUAL ASSISTANCE	1	2	3
4. ADVICE ON CROPPING PRACTICES	1	2	3
5. ADVICE ON LIVESTOCK REARING	1	2	3
6. ASSISTANCE WITH MARKETING OF PRODUCE	1	2	3

9. DO YOU SEEK HELP FROM OTHER FARMERS?
 (1) YES
 (2) NO

10. DO YOU HELP OTHER FARMERS?
 (1) YES
 (2) NO

NOW I HAVE SOME QUESTIONS FOR YOU REGARDING THE EXTENSION SERVICE PROVIDED BY THE RURAL AGRICULTURAL DEVELOPMENT AUTHORITY (RADA)

11. HOW OFTEN DO YOU SEE YOUR EXTENSION OFFICER?
 (1) DAILY
 (2) WEEKLY
 (3) MONTHLY
 (4) OTHER, PLEASE SPECIFY

12. IS THIS ARRANGEMENT SATISFACTORY OR UNSATISFACTORY?
 (1) SATISFACTORY
 (2) UNSATISFACTORY

13. WHEN YOU MEET WITH YOUR EXTENSION OFFICER, IS IT MAINLY ON A ONE TO ONE BASIS OR IN A GROUP FORMAT?
 (1) ONE TO ONE
 (2) GROUP

14. PLEASE RATE THE ONE TO ONE APPROACH VERY GOOD, GOOD, POOR, VERY POOR IN TERMS OF THE FOLLOWING CRITERIA.

	VERY GOOD	GOOD	POOR	VERY POOR
1. RECEIVE KNOWLEDGE WHICH IS USEFUL TO FARMING PRACTICES	1	2	3	4
2. I RETAIN MOST OF THE KNOWLEDGE PASSED ON TO ME	1	2	3	4
3. RECEIVE RELEVANT INFORMATION ON THE MARKETING OF PRODUCE	1	2	3	4

15. PLEASE RATE THE GROUP APPROACH VERY GOOD, GOOD, POOR, VERY POOR IN TERMS OF THE FOLLOWING CRITERIA.

	VERY GOOD	GOOD	POOR	VERY POOR
1. RECEIVE KNOWLEDGE WHICH IS USEFUL TO FARMING PRACTICES	1	2	3	4
2. I RETAIN MOST OF THE KNOWLEDGE PASSED ON TO ME	1	2	3	4
3. RECEIVE RELEVANT INFORMATION ON THE MARKETING OF PRODUCE	1	2	3	4

16. IS YOUR EXTENSION OFFICER AVAILABLE TO YOU IN THE EVENT OF AN EMERGENCY?

(1) YES
(2) NO

17. PLEASE RATE THE FOLLOWING FORMS OF TRAINING IN TERMS OF BENEFITS

	MOST BENEFICIAL	BENEFICIAL	NOT BENEFICIAL
1. CLASSROOM	1	2	3
2. FIELD TRAINING	1	2	3
3. MIXED	1	2	3

18. NOW I WOULD LIKE TO KNOW THE REGULARITY OF EACH COMMUNICATION METHOD USED BY YOUR EXTENSION OFFICER.

	FREQUENTLY	OCCASIONALLY	NEVER
1. ORAL PRESENTATION	1	2	3
2. DEMONSTRATION WITH MATERIALS, e.g. STONES, BOTTLES	1	2	3
3. DEMONSTRATION WITH WRITTEN MATERIALS, e.g. FLIP CHARTS, BROCHURES	1	2	3
4. SLIDES	1	2	3

19. PLEASE RATE YOUR EXTENSION OFFICER VERY GOOD, GOOD, POOR, VERY POOR IN TERMS OF THE FOLLOWING CRITERIA

	VERY GOOD	GOOD	POOR	VERY POOR
1. COOPERATION WITH FARMERS' GROUP(S)	1	2	3	4
2. ORGANISATIONAL ABILITY	1	2	3	4
3. COMMUNICATION SKILLS	1	2	3	4
4. KNOWLEDGE OF FARMING PRACTICES	1	2	3	4
5. KNOWLEDGE OF SOIL CONSERVATION TECHNIQUES	1	2	3	4
6. WILLINGNESS TO DEAL WITH PROBLEMS	1	2	3	4
7. PROVISION OF MARKETING INFORMATION	1	2	3	4

20. HOW OFTEN DO YOU ATTEND TRAINING SESSIONS PUT ON BY THE EXTENSION SERVICE?

- (1) ALWAYS
- (2) REGULARLY
- (3) SOMETIMES
- (4) NEVER

21. IF YOU SOMETIMES OR NEVER ATTEND TRAINING SESSIONS, WHICH ONE OF THE FOLLOWING FACTORS HAS CONTRIBUTED TO THIS

- (1) TOO BUSY TO ATTEND
- (2) TRAINING NOT MEANINGFUL TO MY NEEDS
- (3) OTHER FACTOR, SPECIFY

22. HAVE YOU BEEN ABLE TO IMPLEMENT IN YOUR FARMING PRACTICE ALL THE SUGGESTIONS MADE BY YOUR EXTENSION OFFICER?

- (1) YES
- (2) NO

23. IF NO, WHICH OF THE FOLLOWING REASONS ARE OF MAJOR, MINOR, OR NO IMPORTANCE IN YOUR INABILITY TO IMPLEMENT THE TRAINING SUGGESTIONS.

	MAJOR	MINOR	NOT IMPORTANT
1. EXTENSION OFFICER DID NOT SUFFICIENTLY EXPLAIN INSTRUCTIONS	1	2	3
2. I DID NOT PAY SUFFICIENT ATTENTION TO INSTRUCTIONS	1	2	3
3. UNAVAILABILITY OF MATERIAL INPUTS	1	2	3
4. UNAVAILABILITY OF CREDIT	1	2	3
5. LABOUR SHORTAGE	1	2	3

24. ARE YOU AWARE OF ANY NEW FARMING PRACTICES THAT ARE NOW TAUGHT IN THIS AREA BY THE EXTENSION SERVICE?

- (1) YES
(2) NO

25. IF YES, HAVE YOU BEEN TAUGHT THIS TECHNIQUE BY THE EXTENSION OFFICER?

- (1) YES
(2) NO

26. HAVE YOU RETAINED MOST OF WHAT HAS BEEN TAUGHT?

- (1) YES
(2) NO

27. HAVE YOU MADE USE OF THIS NEW TECHNIQUE ON YOUR FARM?

- (1) YES
(2) NO

TO FINISH UP THE INTERVIEW, I HAVE SOME QUESTIONS ABOUT YOUR FARM AND OTHER BACKGROUND INFORMATION.

28. WHAT IS THE TOTAL ACREAGE OF YOUR FARM?

- (1) UNDER 1 ACRE
(2) 1 - 5 ACRES
(3) 6 - 10 ACRES
(4) 11 - 25 ACRES
(5) OVER 25 ACRES

29. WHAT AREA OF FARMING DO YOU SPECIALISE IN?

- (1) GROWING OF
VEGETABLES
- (2) PERMANENT CROPS
- (3) LIVESTOCK
REARING
- (4) OTHER, PLEASE
SPECIFY

30. PLEASE INDICATE YOUR OWNERSHIP STATUS.

- (1) OWNER
- (2) TENANT
- (3) LEASE
- (4) CAPTURE
- (5) OTHER

31. ARE YOU INVOLVED IN FARMING ON A FULL-TIME OR PART-TIME BASIS?

- (1) FULL-TIME
- (2) PART-TIME

32. IF PART-TIME, PLEASE SPECIFY YOUR OTHER OCCUPATION

33. WHAT IS THE HIGHEST LEVEL OF EDUCATION THAT YOU HAVE ATTAINED?

- (1) NO FORMAL EDUCATION
- (2) PRIMARY EDUCATION
- (3) SECONDARY EDUCATION
- (4) POST-SECONDARY
- (5) UNIVERSITY
- (6) NO ANSWER

34. WHAT IS YOUR AGE? -----YEARS.

35. RECORD RESPONDENT'S SEX

- (1) MALE
- (2) FEMALE

AN INVESTIGATION
INTO FACTORS RELATED TO
HUMAN DEVELOPMENT FOR COMPETITIVENESS
IN THE
JAMAICAN PUBLIC SECONDARY EDUCATIONAL SYSTEM

A Research Paper
Submitted in Partial Fulfilment of the Requirements for the
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ABSTRACT

An Investigation Into Factors Related To Human Development For Competitiveness In The Jamaican Public Secondary Educational System

Sharon Kelly-Stair

Rapid technological change is a characteristic feature of life in today's world. Some consequences of this are the transformation of production processes, work methods, organisational systems and the potential for enhanced trade and investment flows. The effective adoption, generation or adaptation of new technologies for national developmental goals requires a certain orientation and level of human resource development. The secondary education system produces the largest output for the labour market and therefore must be concerned with the implications of technological change.

The paper explores the impact of the requirements for technological development and competitiveness on the secondary education system. Certain cognitive and affective skills including literacy, numeracy, creativity and critical thinking are identified as vital for the development of the technological capability necessary for Jamaica to be competitive.

Criterion referenced tests are utilised to arrive at current levels of proficiency in literacy and numeracy across the range of existing school types. Standardised instruments are also employed in the measurement of creativity and critical thinking, while an interview schedule is used to collect background data on the sample of 403 students from different school types.

The findings point to severe structural impediments in the secondary system which buttress the social inequities which exist in the wider society. These contribute to inhibiting the development of cognitive and other competencies by students especially those of lower social and economic status. Significant differential performance between males and females is also recorded.

The development imperatives facing Jamaica today, suggest the need for urgent policy interventions to enable the education sector and the secondary system in particular to respond effectively.

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SECTION 1

INTRODUCTION

1.1 The Problematic

The issues involved in an examination of the contribution of any educational system to national development are multi-faceted and complex. They are even more so when the educational system under examination represents a kind of hydra. The existing institutional forms, curricular practices and organisational ethos reflect external impulses grafted upon a colonial core. Where, additionally, the development imperatives are more often than not externally derived and fashioned, this produces a situation of dependent economic and social relations within the society which hosts the educational system. The fact that the society is characterised by great social and economic inequities and by the existence of a strong counter culture, expressed in language, music, dress and other aspects is also significant. In this context, the central issues concerning the contribution of the educational system to national development, centre on concerns of instrumentality but must also have a humanistic and empowering content. While this paper focusses on the economic function of education in respect of the development of human resources as a critical factor in the enhancement of international competitiveness, it does so fully recognising the continued important role of educational systems in the social, political, and other domains. The study therefore seeks to examine the extent to which certain skills, which are identified as critical to enhancing national competitiveness, are present among school leavers in Jamaican secondary schools.

Today, technological innovation and diffusion are increasingly perceived as principal avenues to economic growth and global competitiveness [ILO 1987: 66]. The successes of Japan and the Newly Industrialised Countries are said to attest to this. Yet, even in those societies, there is concern as to whether or not the schools are effectively fulfilling their roles. Specifically, concern has been expressed as to the extent to which primary and secondary educational institutions are performing both their instrumental as well as their humanistic functions [Pavri, 1990: 85].

What are some of the implications of the new technological age for Jamaica? The critical importance of

technological development and diffusion as a stimulus to development has been explored by many theorists. The technological potential identified in the current period is allied to new advances in bio-technology as well as the developments in information processing and communications technology embodied in microelectronics. These innovations have produced dramatic changes in production processes and products as well as contributing to new levels of efficiency and productivity [Perez, 1985: 244]. The implications for organisational structures, for work methods and for human interaction are also great. As the innovations which form the bases for these changes are diffused throughout national economies and, by extension, the global economy, it becomes difficult for enterprises and countries to avoid the implications which exist for their own path of development.

Developing countries like Jamaica must explore the implications of the new technologies for their own development and seek to develop the institutional and human capability to facilitate developing, adopting and adapting the new technologies. The imperative is particularly great in the case of raw material producers, such as Jamaica, as the reduction in energy and material content of products, which is a feature of the new technologies, means a thrust towards more information intensive goods. This creates the need for critical policy decisions in the spheres of economic and human development. Jamaica also needs to develop the capability to respond effectively to the new growth in services which is occurring globally, particularly in the spheres of financial and information services. Among the changes which can be observed as a result of technological advance, is an increasing gap "...in scientific and technological capacity between developing and developed countries" [Mennon et al, 1991: 63].

This technological development creates a context of more complex production processes in which there is a need for workers with different qualities than had obtained previously. A more flexible, creative person has been identified as critical to effective use and adoption of the new technologies. Whereas the previous mass production paradigm may not have had literate workers as a prerequisite for meeting production goals and targets, in the current situation literate workers are necessary for effective utilisation of the new technologies [Windham, 1992: 37]. Improved functioning in the area of numeracy has also been identified as necessary to facilitating the absorption and use of the new technologies. This is especially so in the sphere of production where a capacity for abstract reasoning can assist in revealing relations which underlie the link between technology and production

[Cotlear, 1989: 76].

Previously developed technology can be accessed by developing countries, such as Jamaica, and this approach may seem particularly attractive in light of high costs for local research and development. Adopting this course of action to the exclusion of developing local technological capability is fraught with dangers. Reasoning ability or critical thinking skills have been identified as vital to the effective use of the new technologies in addressing production needs [Levin & Rumberger, 1985: 210]. The new technological age also demands the skill of creativity in the application of knowledge to production. For the purposes of this investigation, the critical skills which have been tentatively identified as important for effective functioning in the new technological environment are: literacy, numeracy, reasoning or critical thinking and creativity. These are by no means exhaustive of the skills which are required for effective utilisation of the new technologies. They are simply the necessary pre-conditions upon which other skill development can occur.

For Jamaica to compete effectively regionally and globally, it needs to develop an indigenous technological capability. This requires the development of the human resource capability to build a new technological environment which will encourage innovation and inventiveness. While this process involves not only schools but a plethora of training institutions and enterprises, there are certain spheres in which schools undoubtedly have comparative advantages. Certainly, secondary level education ought to ensure that the knowledge, skills, values and habits which are promoted can facilitate the use of information to address production needs.

There is wide agreement among researchers that the current revolution in information technology creates additional tensions within the formal education system [Schelsky, H. 1969: 35; Heitner, K.L. et. al. 1990: 28]. The impetus towards new policy changes as a result of the changes in the work context due to technological transformation is forceful and compelling. What remains uncertain is, what ought to be the nature and direction of these policy initiatives? Issues of educational quality are of current relevance in both the industrialised and the developing world. Some argue that the average standard of performance in secondary education is declining globally [De Landsheere, 1987: 40]. In Jamaica, while issues of funding and equity do engage the minds of many, concerns about quality also abound [Hamilton, 1991: 3]. Evidence of the performance of the educational system in promoting the kind of literate and numerate populace capable of the

creative thinking and the reasoning which are so critical to technological progress can be seen in the annual performance of Jamaican students in the Caribbean Council Examinations.

TABLE 1.1 PERFORMANCE OF JAMAICAN STUDENTS IN CXC ENGLISH & MATHEMATICS EXAMINATIONS, 1992

Subjects	Entries	1	2	3	4	5
ENGLISH GENERAL	13725	386	2983	6593	3355	408
MATHS GENERAL	12388	847	2599	3286	4408	1248
ENGLISH BASIC	1250	173	576	324	153	24
MATHS BASIC	2887	154	724	718	1048	243

Source: CXC Western Region Office, Jamaica.

Table 1.1 shows that of the total number of candidates sitting the CXC General Proficiency Examinations in English Language from Jamaica in 1992, twenty-five percent achieved scores in Grades 1 and 2. Grades 1 and 2 have been recommended as the levels which indicate a candidate's suitability for further study.¹ For Mathematics, twenty-eight percent of total candidates gained scores in Grades 1 and 2. Forty-eight percent of total English candidates and twenty-seven percent of total candidates in Mathematics, obtained scores in Grade 3. For CXC, the General Proficiency Examination had been designed to measure competencies for further study up to Grade 2, with Grade 3 being considered suitable for the labour market. The Basic Proficiency Examination had been conceived as measuring competencies for the world of work at Grades 1 and 2. The elitist assumptions inherent in such categorisation has resulted in most students aspiring to sit the General Proficiency Examinations regardless of future plans.

The problem of performance at the Secondary level is

¹ In Jamaica, Grades 1 and 2 have been largely requested by employers for skilled employment. Only in 1992, did the Jamaican Government advise that Grade 3 will be accepted for certain categories of employment in the Public Service. In the Basic Proficiency, only Grade 1 has been accepted as a supplement for further study or in many cases for employment.

of particular importance when considered against the background of the purposes of secondary education. Secondary education is supposed to give students a systematic introduction to knowledge, techniques and 'know-how' relevant to functioning in today's society [UNESCO, 1987: iv]. What is widely accepted, also, is that secondary education represents terminal education for many students and that the secondary system ought therefore to aim at developing persons capable not only of doing useful work, but also of benefitting from continuing education and training. This is especially important in light of the challenges currently posed by the new technologies.

1.2 Objectives of the Study

The focus of this study is on the measurement of existing levels of achievement in literacy, numeracy, creativity and critical thinking at the secondary level. Additionally, the study will attempt to suggest some of the factors which may contribute to these and to propose policy interventions which could be employed to address the situation. English Language and Mathematics will be used as proxy measures for achievement in literacy and numeracy, respectively.

Arriving at an operationally sound interpretation of what will be construed as appropriate levels of functioning in the identified skills is fraught with pitfalls. Can there be a precisely defined level of functioning which is desirable for all? Does the concept of minimum levels of competency not contain implicit normative judgements based on assumptions of common values and shared beliefs [De Landsheere, 1987: 42]? In a pluralistic society such as Jamaica, does such a concept help to define the parameters of the problem being studied, or does it simply serve to conceal some of the issues in a mire of vagueness and imprecision? It is undeniable that in the sphere of work there are certain competencies which are vital to the performance of production tasks [Rush, R. Timothy 1987]. These include performance related writing, reading and computation skills. What levels of these skills are required for optimum performance? Are they the same for all occupations?

There is some debate as to what levels of competency in literacy and related skills are vital for job success. Rush argues that whereas the levels of these skills required in skilled and semi-skilled occupations are perhaps more complex than is implied in the term 'functional literacy', only minimal literacy competencies may be necessary for success on the job.

The concepts of literacy and numeracy are themselves

multi-faceted. Indeed there are some interpretations of literacy which not only incorporate a certain facility with language but also the ability to treat with numbers. Literacy in this paper is taken to mean the ability to use language in such a manner as to allow the user to be able to accomplish requisite tasks in the society. Implicit in this definition is an appreciation of not only the instrumental applications of language but also, its empowering possibilities within the social context in which it is expressed.

Here, the competencies are defined in terms of operational literacy and numeracy. That is to say, that level of literacy which contributes not only to the ability to read and comprehend the newspaper or a textbook but also to organise and present ideas logically and clearly. For numeracy, it implies that facility with computation, reasoning and problem-solving which would enable the student to engage in the resolution of simple tasks.

Implicit in all attempts to define literacy is the question of adequate levels of literacy. That issue is, however, only meaningful in terms of the needs and values of a particular society [Jules 1988: 375].

Jamaican society, as it prepares for the challenges of the twenty-first century, requires persons who have attained a level of competence in literacy and numeracy. Certainly a similar level may not be necessary for all tasks but it is the researcher's view that a certain minimum level is an essential precondition for development. For the purposes of this investigation, that minimum level is taken to be the qualities which individuals would need in the different spheres in which they function and develop interests. In the area of literacy, the ability to acquire and interpret information; to evaluate opinions; to communicate and express thought as well as to derive enjoyment through a facility with language are considered significant. For numeracy the significant qualities are: the ability to use basic computational skills effectively; to use these in the solution of problems which arise in daily life whether as consumer or producer and to think logically and critically through the application of these skills. Throughout the paper, literacy and numeracy are used synonymously with English Language and Mathematics. This is done partly in order to give meaning to the secondary school programmes which are principally concerned with the development of these skills and partly to facilitate their measurement. To identify the parameters which delineate the essence of creativity and critical thinking may not be as simple.

Some authors argue that to present a dichotomy between

the processes involved in critical thinking and those involved in creativity is inadequate, that "creative thought cannot be uncritical" [Nickerson, Perkins and Smith 1989: 89]. While it is undeniable that there is some interconnection between critical thinking and creativity, some attempt has to be made to specify the essential characteristics of each for the purposes of this investigation. Creativity is a multi-dimensional trait which can be expressed in diverse ways. In this paper creativity is taken to mean not only originality of thought, inventiveness and imagination, but also ideational fluency.

Critical thinking is construed to represent that ability to evaluate arguments based on their logical coherence. It measures the qualities of arguments based on the patterns of reasoning displayed. It involves processes of deductive reasoning. The term critical thinking skills is used interchangeably with reasoning ability throughout the paper.

Neither creativity nor critical thinking are skills which are often explicitly taught in Jamaican classrooms. The assumption frequently made is that they will be acquired in the process of students developing their cognitive abilities in other fields of study. For example, it has been often advanced that creativity is not independent of language and art forms [Best, 1982: 287]. Neither is critical thinking divorced from the reasoning skills often employed in the solution of mathematical problems. Despite this, however, it can possibly be argued that in the current period both are areas which require direct attention.

1.3 Hypotheses to be Tested

The principal concerns of this investigation centre upon the issue of the levels of literacy and numeracy, as previously defined, among Jamaican secondary school leavers. It can be more broadly construed to pertain to literacy and numeracy within a particular situational context namely, the varied situations in which Jamaican secondary students acquire these proficiencies as well as the experiences which they bring to the process of this acquisition.

The hypotheses are:

1. There is no relationship between levels of literacy, creativity, critical thinking and numeracy and the type of school which a student attends.

2. There is no relationship between students' levels of

literacy and/or numeracy and the levels of creativity and/or critical thinking which they display.

3. Students' levels of literacy, numeracy, critical thinking and creativity are not related to their gender and/or age.

4. Students' socio-economic status is not related to their levels of numeracy, literacy, critical thinking and creativity.

5. The urban/rural location of the school which a student attends does not relate to levels of performance in literacy, numeracy, critical thinking and creativity.

6. The gender composition of the students' school makes no difference to their levels of achievement in literacy, numeracy, creativity and critical thinking.

7. There is no relationship between students' achievement levels and the methods used by teachers in classes.

Various theorists have argued for an understanding of literacy and numeracy which transcends mere functionalism. The need to explore language mastery in the context in which it is achieved and utilised has been identified as a critical area for examination [McLaren, Peter L. 1988: 218]. Writers like Graff and Freire have explored the dimensions of literacy from the standpoint of the extent to which it facilitates the oppression of the powerless by the powerful and the preservation of the existing status quo.

"...the perspectives, values and assumptions built into school-based literacy practices are often left implicit, thus empowering those mainstream children who already have them and disempowering those children who do not and for whom they are never rendered visible save in the negative evaluations they constantly receive."

[Gee, James Paul 1988: 209]

The inescapable conclusion from this is that it is difficult if not impossible to engage in any comprehensive examination of issues of literacy and numeracy without considering the social groups and institutional types which give them meaning.

Any attempt to influence policy prescriptions in education must first confront the issue of what is the existing situation upon which relevant decisions may be based. Inadequate and unreliable data, in the absence of nationwide surveys, has been identified as a major impediment to effective policy planning in education in the

Latin American region [Ribiero, Sergio Costa 1990: 93]. This thesis is no less relevant to the Caribbean context and especially to Jamaica.

The units of analysis which are relevant for this study are the range of existing types of institutions which are broadly described as secondary within the context of the Jamaican educational system with the exception of vocational and agricultural schools. The study therefore seeks to use a variety of tests to measure proficiencies across the range of institutional forms which exist.

1.4 Rationale

The investigation centres on identifying and measuring current levels of performance among Jamaican secondary students in the areas of literacy, numeracy, creativity and critical thinking. It seeks to do so in order to establish existing levels of competence in some of the core areas which need to be addressed in the domain of human resource development if Jamaica is to improve its technological capability and its competitiveness.

The principal unit of analysis is the Jamaican public Secondary system (Appendix 1). For most students in Jamaica, secondary education constitutes terminal education. Levels of achievement on the various tests will be measured at the Grade 11 in order to capture a range of school leavers across school types. As a result, All Age schools, which terminate at Grade 9, have been omitted from the investigation. Agricultural and Vocational schools which fall under the secondary school umbrella, follow specially designed programmes and constitute a very small proportion of the secondary school population [Appendix 2]. The decision was therefore taken to exclude them from the investigation.

Without some idea of the quantitative and qualitative dimensions of the learning gap in literacy and numeracy, critical thinking and creativity, effective policy interventions cannot be implemented. Knowledge of the proportions of the problem however while being necessary, is not sufficient to facilitate implementation of appropriate strategies to correct or minimise the problem, hence attention must be paid to identifying the institutional or other constraints which may inhibit implementation. This study is of critical significance if the secondary school system in Jamaica is to be more attuned to the requirements of preparing young people for a new technological environment.

H. G. Wells stated, "the history of mankind is

increasingly a race between education and catastrophe".² This statement, it could be said, aptly describes the current situation in Jamaica. The development imperative to adopt, adapt and generate the technologies necessary to promote global competitiveness exists. The responsibility of the school system to provide the core of basic knowledge, skills and attitudes as a necessary foundation for future educational and professional development is widely accepted. In Jamaica, insufficient attention has been paid to generating these skills except in the sense of expanding scientific abilities. That inadequate mastery of English Language and Mathematics must inhibit the prospects for generalised transmission of scientific and technological knowledge has been insufficiently considered. This paper, seeks to fill that gap, by focussing on the competencies in language and mathematics education which are essential preconditions for the expansion and upgrading of scientific and technological skills in Jamaica.

SECTION 2

THE BACKGROUND

2.1 The Public Secondary System in the Colonial Period

The public system of secondary education in Jamaica had its genesis in the post-slavery period with the establishment of the 1879 Schools Commission [Gordon, Shirley C., 1974: 31]. Earlier efforts by the churches and individuals through endowments, to establish a secondary system, had resulted in failure for the most part.

A more propitious environment for the promotion of a secondary school system in Jamaica arose as a result of declining sugar fortunes, after 1846, which meant that the resources to send the children of the planters, to England for education were not available. At the same time, the popular notion was that the upper and middle classes ought to receive an education which was superior to the elementary type education, then available to the majority of the black masses.

The colonial government did little to provide the necessary infrastructure for the secondary system, and it

² Edward Cornish, "Introduction to H.G.Wells' The Discovery of the Future", in *Future Researches Quarterly*, Vol. 1 No. 2 1985, pp 54.

was the churches which had taken a leading role in the provision of elementary education which continued to provide the dynamism for secondary education. This situation obtained until well into the twentieth century.

The system has been variously described as elitist and middle-class in ethos, catering to the needs of a fairly, small and select proportion of the population [King, Ruby, 1987: 90]. The fact that secondary education was largely financed by user charges meant that it became "the educational preserve of those who could afford it [Gordon, Shirley C., 1974: 33]." Up to 1911, less than one per cent of the 10 - 19 age group was enrolled in secondary schools [Miller, Errol 1990: 69].

The period 1879-1911, has been described as the formative years for secondary schooling in Jamaica [Miller, Errol 1987: 109]. It was during this time that a secondary educational system began to be institutionalised in Jamaica, and by 1890 a definite structure could be discerned. The Jamaica Schools Commission was responsible for the general supervision and certification of the secondary schools. These included endowed schools, which were reorganised, as well as secondary schools which were operated by the churches or by private individuals.

The Secondary system underwent further modifications in its structure up to 1943. There was some expansion in the institutions offering secondary education by the amalgamation of the church schools into the public system through a grant-in-aid scheme as well as the provision of scholarships for capable students from parishes where there were no secondary schools. While in 1911 there were twelve secondary schools, by 1943 there were some twenty-three schools. Enrolment in public secondary level institutions also more than doubled between 1912 and 1943, increasing from 1,012 to 3,637 [Miller, Errol 1987: 131]. Changes also occurred in the management structure of schools. As a condition for the receipt of government grants, the government could now appoint two members to sit on the Boards of these schools.

Between 1947 and 1957, little was done in practical terms to reform the Jamaican secondary education system. A series of studies of the system were however conducted. Reforms of the secondary system were included in the National Plan 1957-1967. Among these were: the conversion of practical training centres at Holmwood, Vere and Dinthill as well as the Kingston Technical School into Technical High Schools; the extension of the curricula of existing schools through the provision of facilities for technical subjects in the existing plant of several high schools; the increased offering of awards through the

Common Entrance Examination whereby greater numbers of students, from public primary as well as private preparatory schools, were afforded access to the public secondary system; the expansion of some primary schools to offer three years of post-primary education in what were then termed 'senior' schools for those children who were unsuccessful either by virtue of achievement or income in their bid to enter existing secondary institutions. This was the structure of the Secondary school system in Jamaica on the eve of Independence which was granted in August 1962.

2.2 The Public Secondary System After Independence

In the immediate post-Independence period, the Independence Plan 1963-1968 was developed. One of the principal policy changes which resulted from this plan was the award of Common Entrance places on the basis of 70% going to children from primary schools and 30% going to children from preparatory [privately owned and operated] schools. The system was further expanded by the establishment of two comprehensive high schools.³

As a result of a request for multi-lateral assistance in the field of education by the first post independence government, a set of reforms which became known as the New Deal for Education were promulgated. The main policy initiative which derived from this plan was the development of junior secondary schools which were to cater to students in the 12-15 age group on a non-selective basis. Some fifty new schools were built with assistance from the World Bank, and two new and fourteen pre-existing senior schools were converted into junior secondary schools.

This policy initiative was intended to address the weaknesses and class biases inherent in the system. It was argued that expansion of secondary offerings would afford increased opportunities for secondary education regardless of class position. In this way, more than the 10% of the age cohort which was then receiving secondary level education would have been able to access education at that level. Quantitative rather than qualitative considerations appear to have been uppermost in the minds of the policy formulators. The populace, however, was concerned with both issues. It was the secondary education which was offered in the high schools that people wanted their children to have access to and not this new, seemingly inferior curriculum which was being grafted onto the

³ The Trench Town and Frankfield (later re-named Edwin Allen) Comprehensive High Schools in Kingston and Clarendon respectively, were the schools established.

existing primary system.

1972 witnessed a change in government in Jamaica and new policy initiatives in education followed shortly thereafter. The Education Thrust of the Seventies heralded the introduction of free secondary and tertiary education in 1973. In 1974, the programme in the existing junior secondary schools was extended for a further two years and the institutions were now termed new secondary schools. To allow for increased access, a shift system was introduced fully in 35 new secondary schools and partially in the 29 others. This allowed two school communities to use a single school plant over a ten hour period: from 7 a.m. to 5 p.m. In September 1975 all 65 schools went on a full shift system. Several secondary level institutions were expanded and better equipped to meet the demands of increasing student intake, and as a result, there was a 25% increase in the number of students accessing high school education.

The 1980s saw another change in government and a subsequent downgrading of education in the range of priorities as structural adjustment programmes were implemented. There were two principal policy changes in the sphere of secondary education. These included the introduction of the Secondary Schools Textbook Project. Under this scheme, which was funded by the Governments of Jamaica and the United Kingdom, there was the provision of basic textbooks on a rental basis in all secondary level institutions. Initially books were provided only for core subjects including English Language and Mathematics up to the grade 9 level. The programme was later extended to grade 11 and included several other subject texts. Incorporated in the project, were training workshops for teachers to facilitate effective use of the books. An interim evaluation revealed problems in the administration of the programme as well as the inappropriateness of some of the texts for students of low reading ability, many of whom constituted a significant proportion of the student population of the new secondary schools.

Another policy initiative was the upgrading of 14 new secondary and 1 comprehensive high schools. Four were converted into Technical High Schools while the others became High Schools. Facilities were also expanded and improved to meet the new requirements and there was a programme for the upgrading of existing members of the teaching cadre [Planning Institute of Jamaica 1989: 18.8]. Since the 1990s, the newly elected government has promoted a philosophy of continuity: six new secondary schools have been upgraded to comprehensive high schools.

There is imminent reform of the secondary education

system designed to, among other things, rationalise or standardise the curriculum for the first three years, (Grades 7 to 9) across all secondary level institutions. Besides a pilot project, little has been done to date, thus comment may be somewhat premature.

The foregoing gives some understanding of the historical evolution of the secondary education system in Jamaica but some fundamental questions remain to be answered. What have been some of the underlying assumptions which have served to shape and condition the system which has developed? What are the principal features of the secondary education system today? To what extent has the system been achieving its stated objectives? It is only from some appreciation of these issues that one can attempt to examine aspects of the delivery and output of the system.

The basic underlying assumption which informed the formation of the public secondary system in Jamaica was that secondary education was essentially education for a select few. This was later garnished with the belief that secondary education involved the pursuit of certain pre-determined subjects and was therefore curricular oriented. Gradually the perception has developed that secondary education involves the education of a certain age cohort and presupposes the exposure to/mastery of, earlier educational experiences.

The fact that the secondary educational system in Jamaica [Appendix 1] has been quite segmented and has not yet been fully articulated with either the primary or tertiary sectors has meant that the secondary system has continued to reproduce rather than transform existing social cleavages.

The public secondary school system in Jamaica is characterised by the plethora of institutional types involved in the delivery of educational offerings at that level. This phenomenon developed based on the fact that policy prescriptions have been governed less by the requirements of the society and more by external institutions and formations.

There are differences between the existing institutional types. These centre on the methods by which student intake is determined, curricula offerings, teacher supply and qualifications, resource allocation and the examinations which are sat in the terminal grades. Of no less significance is the existing perception among the populace of a sort of hierarchy among secondary level institutions with secondary high school education being the most valued and all-age and new secondary programmes being

the least prized.

In 1990/1991, there were some 31,762 students registered at the grade 11 level in the secondary level institutions identified above. It is noteworthy that some 33% of secondary students registered in the terminal grades were in all-age schools. A small proportion of these would gain access to secondary high, comprehensive high and technical schools through the Grade Nine Achievement Test, but most would have entered the labour market. While grade 11 is not necessarily terminal for some students who may proceed to pursue programmes of further education, the vast majority enter the labour market at this stage. It is these students who constitute the principal focus of this paper.

SECTION 3

LITERATURE REVIEW

Various studies have been conducted to establish the relationship between secondary education and the skill and attitude requirements of the new technological age. A dynamic technological environment such as exists today places a greater responsibility and value on education. It has been argued that in such an environment education is likely to have a positive effect on productivity [Cotlear, 1989: 76]. Cotlear in examining the relationship between schooling and agricultural productivity, posits that schooling facilitates the process of integrating the new technologies in several ways. Increased numerical skills, in particular a greater capacity for abstraction can help to uncover the causal relationships between technology and output which may remain somewhat obscure to the less educated. Literacy can facilitate the acquisition, storage, interpretation, transformation and retrieval of large amounts of information and ease its transmission.

The need for increased investment in education and training in developing countries in order to develop the capacity to exploit technological change as a stimulus to development has been highlighted. Here, the concern is with the need to transform the education curriculum to make it more technologically oriented thus increasing the supply of scientists and technologists [Commonwealth Secretariat, 1991: 62].

Whenever a country begins to lag economically, some attention is often directed at the education system in

order to explain or otherwise justify the slippage. This would seem to suggest a virtually linear relationship between levels of education investment and national competitiveness. But this is not necessarily so. What is more apparent, is that the output of the educational system can contribute to the realisation of the development potential of a country, but, the influence of other factors cannot be discounted.

Some core issues identified by entrepreneurs as relevant to the competitiveness of their countries include the level of human resource development as well as levels of trade and investment flows, the performance of capital markets and the political climate. In the case of South Korea, the quality of the labour force has been cited as a critical factor in the country's gaining a competitive edge in international trade. There, by the 1980s, some 94% of students were enrolled in middle school and 85% in high school [Lau, 1990: 68]. He attributes the upgrading of the literacy and numeracy skills of the workers to the tremendous expansion of the secondary educational system in Taiwan between 1952 and 1981 [Lau: 37]. Similar conclusions are arrived at by Pavri in his analysis of the technological development of Singapore [Pavri, 1990: 85]. The National Committee on Excellence in Education in the United States of America has also stressed that the ability of the US to compete globally in trade and industry is dependent on the level of educational standards [Navarro de Britto, 1986: 13]. Global competitiveness, therefore, has an inescapable educational dimension. Education is considered to be vital "to maintaining or regaining economic progress and competitiveness" [Levin & Rumberger, 1989: 205]

Closer to home, R. Danny Williams, President of the largest insurance company in Jamaica is reported to have bemoaned the quality of education in the island specifically in relation to the dearth of competent and qualified mathematicians. He cited the advantages which an educated work force offers: "There is absolutely no substitute for a trained work force if a country is going to increase its productivity."⁴

The relationship between education and national economic development, has been the subject of many and varied studies over a considerable period of time (Psacharopoulos: 1988). Central to these have been concerns about the relative returns to production and

⁴ Speech to the Jamaica Mathematics Competition Awards Ceremony as reported in The Jamaica Herald, May 20 1993, pp 6.

productivity arising from education to different grade levels and from differing expenditure levels. The suggestion has been that there has been a high correlation between productivity and percentage expenditure on education. (Nettleford:1991, 17).

The characteristics of the new technological age and the prospects which it offers for enhanced development especially to developing societies, has been the subject of several bodies of research(Perez:1985). Some of the characteristic features which have been identified include the rapidity and extensiveness of change. No longer will individuals be able to insulate themselves easily from the impact of the widespread application of technological innovations in everyday life. The blurring of lines and functions between occupational categories indicates a need for a more flexible work force. The rapid economic development and enhanced competitiveness which have been enjoyed by the Newly Industrialising Countries compared to the industrial economies of Europe and the United States as a result of the widespread application of the new technologies of micro-electronics have led to a general assessment of some of the factors which have contributed to this advance. Some have pointed to differing patterns of work organisation, to cultural and other factors as well as to the quality of their human resources. Studies have suggested that a principal contributing factor to the lag in western industrial economies is weakness in the training and development of human resources (ECLAC:1992). It is the quality of the human resource which facilitates the best use and application of technology in the production process thus facilitating competitiveness.

In examining changes produced by the application of new technologies at the micro-level, studies have concluded that the impact of the new technologies on individual organisations is shaped by various factors. These include, the history of the organisation, the type of market in which it functions, its culture and importantly the quality of the human resource available to it and how it is organised.

From the foregoing, the inescapable impression is that there is compelling evidence to suggest a positive correlation between the quality of the human resource available to a nation and its ability to achieve international competitiveness. Some writers posit a nexus between technological advance and the quality of basic education. As Papadopoulos states:

"It should provide the core of basic knowledge, skills and attitudes as the foundation on which subsequent educational and professional careers can be built and the capacity of individuals to cope with change developed." (Papadopoulos: 1988)

Others however contend that while there can be some justification for suggesting some relationship between the educational system and economic advancement, the ways in which secondary education may contribute to economic development are by no means clear.

The link between education and economic development is not as linear as some might suggest. History has proven that education is neither a necessary nor sufficient condition for economic development to occur. For example, the Industrial Revolution occurred without the trained and educated work force which is considered so vital for development today. The nature of the revolution required a human resource which was uneducated, and whose qualifications were the ability to obey orders and to perform repetitive and tedious tasks. Had they been educated, they would have rebelled as they eventually did. Economic development in that context, was the responsibility of the aristocracy and the human development did not necessarily accompany the economic. The revolution in informatics however demands an educated human resource if development is to occur. This is not to suggest that an educated populace can be automatically equated to economic development. The relationship between the two, that is, education and economic development, is very complex and requires the intervention of other factors.

To the extent that there is some kind of relationship between the two however, the issue of in what way do or can changes in one contribute to changes in the other is of some import. The implications of this for the formal system is however, more at issue. For some, increased access to the fruits of technology, such as computers in the classroom is the principal concern. For others, while this may be of some importance what is even more vital are the efforts to prepare the necessary specialised human resources to design, operate, transform and maintain the new technologies [ILO, 1987: 27].

In this regard, the fundamentals of mathematics, science and language have been identified as essential for absorbing the new technologies [ILO 1987:37]. These, together with the development of greater flexibility, creativity, independence and decision-making skills are deemed to be of critical importance. As Levin and Rumberger, posit, "evidence suggests that the level of skills required in the job market are unlikely to change

appreciably in the near future. What is more likely to change are the types of skills required, as new technologies and new forms of work organisation demand different kinds of skills, such as communication and reasoning skills"[1989: 213].

The level of skills required for effective functioning in the technological age may not be as clear as at first appears to be the case. On the one hand the issue of what level of skills are necessary for effective functioning is subject to dispute, on the other it has been noted that even where certain competencies are identified as critical to the production process, these are seldom promoted within elementary and secondary education [Rush, Timothy 1987].

Levine [1982], Lankshear [1985], Freire and Macedo [1987] all are critical of the concept of 'functional literacy' of perceiving literacy purely in terms of 'a set of skills or as the ability to use skills' within a certain context. It is essential to understand literacy and numeracy functioning within existing social realities. It is difficult in this context to arrive at a standardised approach to literacy or numeracy since the knowledge needed to function in different social situations must of necessity be varied.

Some theorists posit that some reasons for under-achievement or the existence of illiteracy in schools may be the dominant middle class culture which pervades the educational system resulting in the marginalisation of those whose origins and perspectives do not accord with the assumed norm. In this circumstance, 'children who are streamed into lower-level school programs are less likely to gain proficiency in reading and writing...'[Jules, Didacus 1987: 79].

But what are the skills and values and the particular knowledge base which are of particular necessity in promoting competitiveness and where should they be developed?

The National Committee on Excellence in Education in the United States emphasized that the ability of the American society to compete internationally in trade and industry depended on educational standards of excellence. In relation to developing societies, it is argued that the education system has an even more pivotal role to perform in the development of an educated work force capable of managing technological change. The Commonwealth Secretariat pleads for the recognition of the vital role of improved human resource development in enhancing the ability of developing societies to absorb, adapt and utilise the new technologies as well as promoting the

capacity for indigenous technological innovation (Commonwealth Secretariat: 1991, 115).

This suggests that the educational system will be essential to the thrust to enhanced competitiveness. But at what level and in what ways? The issue of the relative importance of the differing levels of the formal educational system is a largely spurious debate. The proper articulation of all levels and the nature of the content developed is of more importance if education is to continue to be valued in some societies.

The issue of what is most vital for formal learning is of greater significance in the context of identifying the ways in which the formal education system can contribute to enhancing global competitiveness. This centres on issues of what should be the directions in curricular development in order to promote enhanced competitiveness. The current debate centres on two main issues: one, the promotion of a more "technologically oriented curriculum", (Commonwealth Secretariat, 1991: 63) in which science, technology and computer literacy would hold pride of place. The other approach suggests that precisely because an important feature of the current technological wave is its knowledge intensity, the ability to use information effectively to address production needs is going to be largely dependent on the development of basic skills such as literacy and numeracy [Levin & Rumberger 1989, 210]. Pavri in his examination of the impact of technological advance on the education system of Singapore, cites evidence of a "strong push in both primary and secondary schools to develop computer literacy in students" and a subsequent decline in interest in the more humanistic aspects of the curriculum [Pavri 1990, 85]. Additionally some argue for a more vocational focus in educational institutions in order to develop lower level skills for industry. The changing skill requirements for technologically driven industries frequently means that the skills acquired in school could be obsolete by the time the student enters the world of work.

This could be minimised by increasing articulation between the education system and the industrial sphere but unless the schools have the resources to rapidly change to meet the new skill requirements arising from technical change a closer relationship between school and industry may be of little consequence. Perhaps, the issue could be the fostering of a creative and critical thinking ethos to enable students to be more flexible and adaptable in the world of work. It is only by preparing students to have an openness and receptivity to change that they can be adaptable to changing requirements, and be willing to re-tool themselves when new skills are demanded.

Some theorists have turned their attention to examining whether or not these skills can effectively be taught. For some, creativity cannot be separated from specific disciplines. Creativity here is perceived as difference within an accepted framework and it is argued that conditions for the flourishing of creativity can be created within a classroom setting [Best, 1982: 294]. Research seems however to point to evidence which suggests that critical thought is a necessary although insufficient precondition for creativity [Perkins, 1982].

Critical thinking has been likened to deductive reasoning involving logical inference in a process of arriving at valid conclusions. Research attests to difficulty judging the logical validity of an argument detached from its empirical content [Feather, 1965; Wason & Johnson-Laird, 1972]. This means that if the arguments presented and the conclusions arrived at appear to be true although they may be invalid, there is a tendency to erroneously evaluate the arguments.

The institutional level which may be best able to equip students to be able to respond effectively and to initiate technical change is of some concern. Some argue that it is tertiary level education which best lends itself to the promotion of the technical knowledge and the problem-solving skills which are essential for technological innovation (Levin & Rumberger). Others suggest that training for production is best conducted within the particular enterprises which need the skills for development. Still others suggest that a combination of both approaches in the context of a realistic national development plan, best affords prospects for technological advance. As an ILO study succinctly states: it is "now generally agreed that schools should concentrate on where their comparative advantage lies, that is, those activities of skill and knowledge development which firms are relatively speaking ill-equipped to undertake" [ILO:1987].

The secondary system is advanced as being best able to provide the foundation on which higher level skills can be developed as well as providing the critical core necessary for the world of work. Secondary education is supposed to give students a systematic introduction to the techniques of knowledge as well as produce students able to enter and function in the world of work. Changes have occurred in the institutional form and purposes of the secondary system historically. Previously the students were more homogeneous and the purposes of the system were less economic and more social and political. Today, the gap between the secondary school and social reality is widening as obsolete content and methods of teaching hold sway. The challenge of the new technologies makes a revision of the

system virtually inescapable. Indeed, it has been argued, that one of the principal reasons for the poor performance of students in secondary schools today, is the fact that in most cases, outdated educational methods "have not been systematically modified in the light of changes in the composition of the school-going population" [De Landsheere, Vivian 1987: 40].

Certain cognitive and affective skills have been identified as being of particular significance in facilitating effective functioning in the new technological environment. These include the "fundamentals of mathematics, science and language" [ILO]. The development of creativity, independence and decision-making skills has also been identified as being of critical importance. A survey among workers in the USA concerning the skills which they felt were of importance in the production process today, confirms the primacy of mathematics and reading as important attributes. They identified mathematics as being of critical importance in the programming of computer controlled machinery, "workers will have to learn to think in terms of geometric planes and Cartesian co-ordinates" [Heitner et al : 1990, 28]. The suggestion from the findings is that the workers felt that the need for basic literacy and mathematics skills will increase in the coming years.

The concept of literacy is however fraught with definitional pitfalls. All attempts to define the concept must confront the issue of standards. What level of literacy is desirable? Who determines the appropriate level? Many researchers, [Clarke, 1979; Jules 1988; Lankshear, 1986] point to a socio-cultural dimension to the concept. This means that concepts of literacy are mutable within and between societies. Indeed Lankshear goes further to illustrate a nexus between literacy standards and prevailing power relations. He argues that functional literacy programmes are predominantly exercises in social control designed to preserve the existing status quo. Freire suggests that there should be a liberating, creative component in all educational programmes including those directed at promoting literacy skills. The acquisition of literacy therefore must enhance human potential and not be purely instrumental.

Several studies have identified the socio-cultural dimensions of language learning and mathematics education in Jamaica [Isaacs: 1984; Craig, 1986]. These point to social class, ethnic origin and other variables as directly impinging on the ways in which language and mathematics are learned. While these are of importance, they do not constitute the primary focus of the study. Suffice it to say that the main concern here will be in the context of

the new technological age where the capacity to analyse, summarise and evaluate will be paramount - what level of literacy and numeracy exists among Jamaican secondary school students and what constraints exist to their improvement.

This study will seek to contribute to filling the information gap concerning two of the potentially important educational ingredients in indigenous technological capability. It limits itself to literacy and numeracy because several studies have already pinpointed the relationship between scientific learning and technological capability [McIntyre, 1987: 5].

SECTION 4

METHODOLOGY

The central issues to this paper namely, the present levels of literacy and numeracy, expressed in terms of Mathematics and English Language competencies, among Jamaican secondary school leavers are examined using empirical data. The measurement of these as well as of creativity and critical thinking were undertaken in order to establish the levels of functioning in these areas which have been identified as some of the important preconditions for developing an indigenous technological capability. The study was conducted using principally survey research methodology. A representative sample of Grade 11 Secondary School students was interviewed using a structured interview schedule to obtain background data. Five tests were also administered to the students: one each in Mathematics and English Language, two in Creativity and one in Critical Thinking.

Elite interviews were also conducted among selected actors in the Secondary Schools visited. Aggregate data were used to facilitate comparative analysis where appropriate.

4.1.1 Structured Surveys

Survey research methodology involves instrument design as well as the collection, quantification and analysis of data. This method was employed because it was felt to be the optimum method by which the levels of performance of school leavers in English Language and Mathematics could be measured. This methodology facilitates the rigorous testing of the propositions advanced and assists in the

generation of explanatory models as the relationships of the different variables are explored.

The method has also assisted in the identification of significant variables as well as in the development of meaningful generalisations. Every effort has been made to carefully report the procedures followed to facilitate possible replication. Indeed it is hoped that the use of this methodology will have succeeded in providing what Babbie describes as "one method of empirical verification" of the propositions advanced in this paper.

It has been suggested that the educational situation readily lends itself to the use of this methodology because subjects possess personal abilities which render them suited for the purposes of survey methods and they are easily available to the researcher since they are all in one location. [Babbie: 1973, 48]

The writer is mindful of the danger of perceiving survey research methodology in a positivist light and it is principally for this reason that validation of the data collected has been sought from qualitative as well as other quantitative sources.

4.1.2 Elite Interviews

Elite interviews were conducted among sixteen teachers: eight each of Mathematics and English Language representing the range of school types included in the survey. Eight Principals were also interviewed.

The elite interviews were intended to collect data on the perceptions of teachers and Principals about factors affecting the current performance of students in English Language and Mathematics in schools. This, it was felt, would aid in reconstructing the dimensions of the problem as well as in advancing possible solutions. It also aided in evaluation of the validity of some responses of students to curricular questions. They provided an important qualitative dimension to the research project.

Teachers and Principals in schools possess specialist information about the performance of students which could be most readily accessed in this manner. This information is vital for supplementing the data obtained from the students through the survey [Manheim & Rich:1986, 133]. The teachers of Mathematics and English Language to 11th grade students are themselves engaged directly with the students which renders them most valued sources of information.

4.1.3 Aggregate Data

Aggregate data relating to national levels of literacy as well as levels of achievement in CXC Mathematics and English Language will be used. These will help to situate the data generated by this research project within existing parameters and to facilitate comparative analysis.

4.2 The Instruments

The English and Mathematics tests consisted of sixty multiple choice items based on the types of items in use for the Basic examinations of the Caribbean Examinations Council. These were used because these types of items have established a reputation for consistently measuring some of the qualities which express the concepts of literacy and numeracy as defined for the purposes of this investigation. They are also supposed to be biased in favour of those students who are more likely to enter the labour force than those who will be pursuing continuing studies.

Creativity was tested using the Minnesota Test of Creative Thinking and an adaptation of the Southern California Test of Divergent Thinking. The Ennis-Weir Test of Critical Thinking was also employed. An interview schedule was also administered to respondents.

4.2.1 Interview Schedule

A thirty-one item structured interview schedule was used to collect socio-economic and attitudinal data from each student [Appendix 3]. These data assisted in situating each student within a particular curricular group among 11th grade students. Students' feelings about learning English Language and Mathematics as well as their perceptions of the extent to which teachers of these subjects employed methodologies which facilitated their learning, were measured.

Students were also required to self-evaluate their current achievement levels in English Language and Mathematics. Constraints to learning were to be identified where these were perceived to exist.

Items pertaining to the education and occupations of parents/guardians as well as size of family were included as socio-economic indicators.

The interview schedule was pre-tested during the last week of February in two schools, representing two of the four types which were studied. A New Secondary School in Kingston and a Secondary High School in St. Andrew were visited for this purpose. These two types of schools were

selected because, according to popular opinion, they represent the least valued (in the case of the New Secondary) and the most highly prized (in the case of the Secondary High) types of secondary level institutions. Refinements were made based on the extent to which items were readily understood by respondents in both schools. Assessments were also made by relevant teachers of the likelihood of students being able to satisfactorily respond to the items in the English Language and Mathematics tests.

The background data on students'/parents'/guardians' occupations could perhaps have been obtained from records held in each school, but this was not possible because of the reported confidentiality of such school records.

The interview schedule was administered by the researcher in 90% of the cases. Each student was taken to a private corner, usually in the area designated for the tests, where the details of the information given could not be overheard, to guarantee confidentiality.

Questions were asked orally by the researcher and, where necessary, it was possible to probe answers to ensure that the response accorded with the nature of the information being sought. In cases where students either reported, or appeared to possess low literacy and comprehension skills, the researcher attempted to facilitate understanding by not only making the language of the question as simple as possible in standard English but also by translating it into the vernacular where it was deemed to be necessary.

In 10% of the cases the subjects themselves completed the interview schedules in the presence of the researcher who then checked them to verify that the data given were complete and where gaps existed or the response was not clear then clarification was sought. Interview schedules were in some instances completed prior to the students' doing the tests and in other instances subsequent to their having done so. The principal factor which determined when they were completed was the order in which the school was visited in the researcher's schedule. Students in schools which were visited early in the day were usually interviewed prior to doing the tests while the opposite occurred in the case of schools which were visited later in the day.

4.2.2 The English Language and Mathematics Tests

The sixty multiple choice items which were contained in each test represented items based on the Caribbean Education Council's (CXC) Basic Proficiency Level for English Language and Mathematics [Appendices 4 & 5].

Although many students in the sample and a majority of students from New Secondary Schools were not pursuing CXC type programmes, it was felt that they represented a level of proficiency which had already been assessed as being suited to the world of work. Besides, there are no other official tests which are tailored to measure the curricula of the variety of secondary level institutions which exist in Jamaica. The CXC type items utilised would therefore reflect some, but not all, aspects of the curricula which would be pursued by all students in secondary level institutions which exist in Jamaica.

In the case of Mathematics, the items sought to measure performance levels within the following areas: Sets, Relations, Functions and Graphs, Computation, Number Theory, Measurement, Consumer Arithmetic, Statistics, Algebra and Geometry. The paper was weighted most heavily in terms of items on Consumer Arithmetic, Algebra and Geometry and least in terms of Sets. The items were also designed to measure problem solving skills as well the ability to think logically and critically.

The English Language items were concerned with measuring the ability of the students to understand meaning conveyed through vocabulary, sentence patterns and paragraph construction. The extent to which information was interpreted, relationships perceived, conclusions and inferences drawn, the effectiveness of language devices evaluated, and information communicated were also measured.

The reliability and validity of the items had already been established through regional testing among 11th grade students. This, together with the measurement objectives of the items, rendered them most suited to the researcher's purposes.

The tests and the questionnaire were perceived to be the most efficient methods of collecting the range of data required from the sample of students studied.

4.2.3 The Creativity Tests

The Circles Test is a non-verbal creativity test which requires subjects to draw as many objects as they possibly can from twenty circles, by adding lines either inside and outside the circles, or both inside and outside [Appendix 6]. The Words Association Test on the other hand, is a verbal test of creativity. The subject is in this situation presented with a list of forty-five words, five of which were repetitions, so effectively the students were faced with forty. They were required to write as many related words as they could beside each of the words [Appendix 7].

Some success has been reported in establishing both reliability and validity for creativity tests. Both measures, according to research findings, provide a reasonably accurate gauge of creativity in adolescents. Getzels and Jackson (1962) obtained a reliability coefficient of 0.87 for the Word Association Test. The reliability coefficients for the battery of tests of which the Circles Test is one ranged from 0.75 to 0.85 (Torrance and Gowan: 1963). Richardson (1984) obtained a reliability of 0.81 for the Circles Test using Jamaican adolescents.

4.2.4 The Critical Thinking Test

The Ennis-Weir, Critical Thinking Test was used [Appendix 8]. Although specific reliability coefficients could not be located, the test and variations thereof have been used by Brandon & Nolan (1984) and Brandon (1990) in measuring critical thinking abilities among Jamaican secondary school students and teachers in training. Ennis himself argues that the very concept of reliability may be difficult to apply to a critical thinking test because of the heterogenous nature of critical thinking ability. He also pithily states, "those who develop critical thinking tests will find it difficult to make a convincing case for their validity" [Ennis, 1984: 7].

The test required that students read a letter concerning problems of street congestion due to overnight parking. They then had to evaluate the arguments presented in each paragraph of the letter for relevance of arguments, ambiguities and other weaknesses. A final paragraph was to be presented containing an overall assessment of the total arguments made.

The test contains some culturally specific formulations, which may not readily be considered a part of the experiences of Jamaican students.

4.2.5 Scoring Procedures

A key for correct answers to the Mathematics and English Language Tests was developed using Grade 11 teachers of the respective subjects [Appendices 9 & 10]. They were moderated by University lecturers who are specialists in the relevant areas. Each correct answer received one mark and the total marks were then converted to percentages for ease of analysis.

The Circles Test was scored for originality with weights being attached to the uniqueness of the drawings presented. Where more than 20% of the students had a particular drawing, for example a clock, they received 0 for their effort. Designs which were done by 5% or less

obtained 2 and those done by 6% to 20% received 1 [Appendix 11].

The Words Association Test was scored for fluency with one mark being awarded for each related word listed by the students.

The Ennis-Weir Critical Thinking Test was scored based on weights being attached to the level of analysis and the number of reasoned arguments presented by the student [Appendix 12]. The researcher did not penalise students for incorrect grammar, spelling or other flawed application of the techniques of language.

4.3 The Sample

The survey involved the use of probability sampling techniques at each stage. This was done in order to capture the prevailing characteristics of the population in the sample, as well as to facilitate generalisations within specified limits.

4.3.1 The Sampling Frame

There were two principal sampling frames which were utilised. First, there was the frame used to draw the sample of schools which should be included in the survey. This was a list of public educational institutions in Jamaica for the year 1990/1991 issued by the Ministry of Education and obtained from the Documentation Centre in the Faculty of Education. While that list was up-to-date in the sense that no new secondary educational institutions had been built between 1990 and 1993, it failed to capture some of the changes which had taken place within the system.

In September 1991, six New Secondary Schools had been reclassified as Comprehensive High Schools, these were: Norman Manley, Bridgeport, Bellefield, Muschette, Anchovy and Petersfield (Planning Institute of Jamaica:1992, 18.3). This change was not taken into account in the selection of the sample.

The researcher, could possibly be accused of committing one of the cardinal sins of survey research by using a sampling frame which was not complete, accurate and up-to-date in all respects [Abdullah:1986, 13], but the extent to which this would have affected the quality of the data collected could however be debatable. The method by which Secondary Schools have been upgraded or reclassified to initially High Schools and later to Comprehensive High Schools has left much of the undervaluing of the curriculum offered in these schools intact. The changes were intended

to occur on a phased basis, hence in most instances even where schools have been reclassified for four years, the 11th Grade students would have been those who were admitted under the previous classification.

The foregoing is not meant to excuse the weakness in the sample frame used but simply to state that it occurred and to explain that it may not have affected the quality of the data obtained in any significant manner. The first aspect of the frame consisted of 138 public secondary educational institutions in Jamaica.

The second aspect of the sampling frame involved the total number of 11th grade students in public secondary educational institutions. A list of students obtained from the Statistics Section of the Ministry of Education for the academic year 1989/1990 was obtained. This showed a total of 36,678 students in the existing Grade 9. While some change would have occurred in this figure as a result of drop-outs, repetition, new intakes or migration, they would have been unlikely to have been of great significance.

There was perhaps what could be termed a third aspect to this issue of sampling frame: within each educational institution in the sample, the list of students currently in the Grade 11 was used to select subjects.

4.3.2 Methods of Selection and Stratification Variables

From the outset, care was taken to ensure that the sample studied would be sufficiently scientifically drawn to facilitate generalisation to the wider population of 11th graders of public secondary institutions.

Researchers have established that in cases where the population is relatively small, viz. under 2,500 units, "fifty per cent of the universe in the sample will give more than the required accuracy" (Manheim & Rich:1986, 342). Thus, for 138 public secondary institutions, at a 95% confidence level, the sample drawn was 70 institutions. For the student population, with a 95% confidence interval, the sample size was 397 students.

Certain variables of interest were identified for purposes of stratification. This was done in order to ensure that the final sample selected would be representative of the general population with respect to the variables of interest.

The principal stratification variables were school type (secondary high/comprehensive high/new secondary) and school location (urban/rural). Secondly, the gender composition of the school (boys/girls/co-educational) was

a factor in the stratification procedure. Schools were grouped according to type and location - 69% were urban with 31% being rural. Within the category of Secondary High Schools there was further stratification according to the gender composition of the school (see Appendix 2). The sample of 70 schools was then chosen randomly, the numbers selected representing their relative incidence within the universe of public secondary level institutions.

At the institutional level, selection of six subjects was made using random number tables and numbering the total number of students on record in the school. It was very time consuming as, on occasion, the students selected were either absent from school or involved in activities from which they could not be excused. In such cases, substitutes were also randomly selected. In two institutions, it was impossible to select the subjects randomly because of the lateness of the arrival of the researcher in one instance, and internal school difficulties in the other. No attempt was made to include gender stratification in the selection of students at the institutional level. Six students were selected in each of the institutions.

4.3.3 Response Rates

Of the 70 schools selected, 69 were actually visited; some, on at least two occasions. The researcher did not visit one, a New Secondary School, because of difficulty in rescheduling, after the initial date proved inconvenient to the school's authorities. Data were actually collected in 68 schools from some 407 student subjects. Except for the Ennis-Weir Critical Thinking Test which proved difficult for many students, the response rate to the tests was fairly high.

The response rate to the questionnaires was 100%; to the Mathematics and English Language Tests it was 97%; to the Creativity Tests it was 90% while to the Ennis-Weir Critical Thinking Test it was 54%. This could have been due not only to the nature of the tests in terms of cultural specificity but also to the process whereby the tests were done. The length of time required to complete the tests was also a significant factor since students probably suffered profoundly from mental fatigue as a result of being required to finish all tests in one sitting.

The schedule of the researcher and the requirements of the programme necessitated completing the fieldwork within two months, March and April 1993 (see Appendix 13). This meant that on certain days two and even three schools had to be visited. Students were required to complete all

tests within a four to five hour period. Usually, the English and Mathematics Tests were completed prior to their doing the Creativity Tests with the Critical Thinking Test being done last. Except for the English and Mathematics Tests, the order in which the other tests were done was determined by the students, but the process described above was generally the norm.

4.4 Gaining Access

The methods of gaining access have been identified as being critical to the research process since, besides being essential to the conduct of the research, it can influence the reliability and validity of the data collected. This is especially so in schools where authority may reside at different levels (Burgess: 1987, 45).

Besides an official letter introducing the researcher and indicating the purposes of the project and the likely date of visit, which was mailed to Principals of schools in the sample, permission to conduct the survey was sought and obtained from the Jamaican Ministry of Education. The letter from the Ministry of Education was taken by the researcher on each visit.

Access was withheld on only one occasion when a certain Principal was absent and the Vice-Principal would not sanction the survey, notwithstanding the letter from the Ministry of Education which was presented. In another case, the researcher had to make three visits before finally being able to conduct the research because the Principal had no interest in the school being included in a survey.

In the main, there were few problems in gaining access although negotiations had to be undertaken by the researcher, in a few situations, with different levels of the system including form/subject teachers to obtain the required sample. In some New Secondary Schools, the full list of students was not readily made available to the researcher. Principals attempted, in these cases, to eliminate students whom they described as 'non-functional'. These were students whose literacy and numeracy skills had been assessed by the school to be of a low level. Nonetheless, further explication of the purposes of the survey by the researcher always produced cooperation in this regard.

The fact that the researcher is a professional colleague may have aided the process somewhat, particularly in cases where no prior notification had been received by the school as a result of a faulty postal system.

SECTION 5ANALYSIS OF THE DATA5.1 Characteristics of the Sample**TABLE 5.1 SCHOOL LOCATION BY GENDER COMPOSITION OF SCHOOL IN SAMPLE**

School Location	Single-sex Girls	Single-sex Boys	Co-Educational	Total
Urban	6	4	36	46
Rural	1	0	20	21
TOTAL	7	4	56	67

The schools which were involved in the survey reflected the population's distribution by region and school type as illustrated in Table 5.1.

Some forty-six schools which were located in urban areas (see Appendix 14 for Statin designation of rural and urban areas in Jamaica), were included in the survey. The component from rural areas in Jamaica was twenty-one schools. The gender composition of the schools reflected all types distributed between both locations. In the case of rural boys' schools, the one which exists was not selected for sampling purposes (Table 5.2). Sixty-eight percent of the sample, consisted of urban schools while the remaining thirty-two per cent was comprised of rural schools. Ten per cent of the sample were single-sex girls schools while single-sex boys' schools accounted for six percent. Co-educational schools comprised eighty four percent of the sample. This compared quite favourably with the national picture.

The national distribution of schools by gender composition and location is represented in Table 5.2, below, which shows, that of a total of one hundred and thirty-eight public secondary level educational institutions, thirty-one percent are located in rural areas with sixty nine percent being situated in urban areas. Single-sex girls' schools accounted for ten percent of the total number of schools while single sex boys schools constituted six percent of the system as a whole. Eighty-four percent of all public secondary schools were co-educational. The sample was therefore representative of the population from which it was selected.

TABLE 5.2 NATIONAL DISTRIBUTION OF SCHOOLS BY GENDER COMPOSITION AND LOCATION

Gender Composition of Schools

School Location	Single-sex Girls	Single-sex Boys	Co-Educational	Total
Urban	12	7	76	95
Rural	2	1	40	43
TOTAL	14	8	116	138

Source: Ministry of Education Statistics 1991.

The gender distribution of respondents across school types is depicted in Table 5.3. Forty-four per cent were males while fifty-six per cent were females. Females represented the larger proportion of respondents across all school types. In Comprehensive High Schools some sixty per cent of respondents were female but these schools accounted for only seven percent of total respondents.

TABLE 5.3 GENDER DISTRIBUTION OF RESPONDENTS BY SCHOOL TYPE

Gender Distribution

School Type	Male	Female	Total
NEW SECONDARY	62	81	143
SECONDARY HIGH	89	105	194
TECHNICAL HIGH	16	22	38
COMPREHENSIVE	11	17	28
TOTAL	178	225	403

The 403 respondents who participated in the survey were distributed across school types and regions as represented in Table 5.3. Secondary High schools produced some forty-eight percent of the total respondents, while New Secondary schools accounted for thirty-six percent. Despite changes which have occurred in the status of some New Secondary schools as a result of the secondary schools upgrading programme, the number of respondents from

Secondary High schools seems disproportionately high.⁵ The situation in Grade 11 may be some what different since, it could be argued that, there is likely to be a higher rate of drop-out for students of New Secondary schools.⁶

In 1991, females accounted for fifty-three percent of the total school population in Grade 11 while males accounted for forty seven percent. Forty-five percent of all students attended New Secondary schools while forty percent attended Secondary High schools. Comprehensive High schools accounted for some five percent of the total population in Grade 11 in public secondary educational institutions. The fact that six New Secondary schools had been upgraded to Comprehensive High schools in September 1991 may explain some of the observed difference between the population and the sample.

TABLE 5.4 DISTRIBUTION OF GRADE 11 STUDENTS BY GENDER AND SCHOOL TYPE

School Type	Gender Distribution		Total
	Male	Female	
NEW SECONDARY	7,197	7,037	14,237
SECONDARY HIGH	5,305	7,262	12,567
TECHNICAL HIGH	1,619	1,606	3,225
COMPREHENSIVE	830	906	1,736
TOTAL	14,951	16,811	31,762

Source: Ministry of Education Statistics 1991.

⁵ In 1991, Secondary High schools accounted for forty-one percent of the total population of public secondary institutions, excluding All Age and Vocational Agricultural schools. For New Secondary schools, the proportion was forty-three percent. Planning Institute of Jamaica, Economic and Social Survey, Jamaica 1991, p 18.7

⁶ This would be due in part to the public perception that the programme of New Secondary schools is not as 'worthwhile' as that offered by Secondary High schools. Additionally some New Secondary students do gain admission to Secondary High schools through unofficial channels based on expertise in sports and other cultural activities.

TABLE 5.5 AGE DISTRIBUTION OF RESPONDENTS BY GENDER

Gender Distribution			
Age	Male	Female	Total
14	0	1	1
15	20	20	40
16	72	95	167
17	69	89	158
18	15	19	34
19	2	1	3
TOTAL	178	225	403

The ages of respondents ranged from a low of fourteen years, to a high of nineteen years, (Table 5.5). While this variation seems large, it is possible within the existing admission practices in Jamaican Secondary schools. Eighty-one percent were either sixteen or seventeen years with fourteen and nineteen years accounting for a mere one percent of respondents when taken together. Fifty-two percent of females and fifty-one percent of males fell in the age group sixteen years and under.

Some sixty percent of respondents indicated that they expected to sit subjects in the CXC examinations this year, (Table 5.6). Forty per cent indicated that they would not be doing so.

Thirty percent indicated that they were not entered for any other examination during this academic year. Some of the students entered for CXC were also entered for a range of other examinations with four per cent of total respondents being entered for no examination.

TABLE 5.6 STUDENTS SITTING CXC BY STUDENTS SITTING OTHER EXAMINATIONS

Other Exam.	CXC		Total
	Yes	No	
YES	133	148	281
NO	108	14	122
TOTAL	241	162	403

Parents'/guardians' occupational level and level of education attained were used as crude indicators of students' social and economic status. Appendix 20 and Appendix 21 show the relationship between the education level of parents/guardians and the school type attended and the occupation level of parents/guardians and the school type attended. In the case of male parents, the fact that one hundred and nine respondents did not live with, or receive support from them, needs to be noted.

5.1.2 General Trend of the Results

Table 5.7 illustrates the distribution of students responses indicating their opinions about learning English Language and Mathematics. Thirty-eight percent of respondents had less than positive feelings about learning Mathematics in school.

TABLE 5.7 STUDENTS' OPINIONS ABOUT LEARNING ENGLISH LANGUAGE AND MATHEMATICS

	English	Mathematics
Students' Opinions	Frequency (%)	Frequency (%)
STRONGLY DISLIKE	.7	7.4
DISLIKE	1.7	10.4
INDIFFERENT	22.8	20.3
LIKE	30.3	25.3
LIKE VERY MUCH	44.4	36.5
TOTAL	100	100

For English, twenty-five percent had a similar perspective about learning the subject. For both Mathematics and English, the single largest proportion of students registered strongly positive feelings about learning the subjects.

Most students assessed the methodologies employed by both their Mathematics and English teachers in classes as facilitating their learning, (Table 5.8). In the case of English, eighty nine percent of respondents felt that the methods employed by their teachers aided student learning. For Mathematics, eighty-one per cent of the sample responded that the methods employed by their teachers facilitated learning. A higher proportion of students responded that their Mathematics teachers did not

facilitate learning than did those for English Language.

TABLE 5.8 STUDENTS' ASSESSMENT OF SUBJECT TEACHERS' INPUT IN THE LEARNING PROCESS

	Mathematics	English
Assessment	Frequency (%)	Frequency(%)
POSITIVE	80.6	88.8
NEGATIVE	19.4	11.3
TOTAL	100 (N=396)	100 (N=400)

When students who assessed their teachers' methods positively, were asked to specify the methodologies employed, which were believed to assist the learning process, most students identified expository, teacher-centered methods. As one of the respondents so succinctly stated: "the teacher goes over and explains until we understand". Some seventy and seventy-one percent of respondents identified these types of methods as those which particularly facilitated their understanding of English Language and Mathematics respectively. Little weight was attached by students to more inductive or more creative methodologies.

For those who evaluated their teachers' contribution to learning negatively, several identified various professional limitations in the teacher. Attending classes late or not at all; assigning tasks from the textbook and without adequate explanation, leaving the students unsupervised to conduct conversations with other teachers, and verbally abusing students were just some of the weaknesses cited. In fifty-seven percent of cases where students evaluated their English Language teachers' contribution to learning negatively they suggested that some personal attribute of the teacher needed improvement. For Mathematics, fifty-six percent of respondents who expressed the view that their teacher did not aid their learning, responded similarly.

Table 5.9 shows students' evaluation of their current levels of achievement in Mathematics. Fifty-three percent of students evaluated their current level of achievement in Mathematics as being either 'Fair' or less than fair. Sixteen percent of respondents however, assessed their current performance in Mathematics as being 'Very Good'.

TABLE 5.9 FREQUENCY DISTRIBUTION OF STUDENTS' SELF-EVALUATION OF THEIR PERFORMANCE IN MATHEMATICS

Evaluation	Frequency	Percent
VERY POOR	16	4
POOR	60	15
FAIR	138	34
GOOD	124	31
VERY GOOD	64	16
TOTAL	402	100

Forty-four percent of respondents evaluated their performance in English Language as 'Fair' or worse, (Table 5.10). Some forty-one percent of respondents assessed that their level of achievement in English was 'Good', while, for fifteen percent, their performance in English Language was 'Very Good'.

TABLE 5.10 FREQUENCY DISTRIBUTION OF STUDENTS' SELF-EVALUATION OF THEIR PERFORMANCE IN ENGLISH LANGUAGE

Evaluation	Frequency	Percent
VERY POOR	2	1
POOR	19	5
FAIR	153	38
GOOD	168	41
VERY GOOD	61	15
TOTAL	403	

The possession of textbooks was identified as a variable which could critically affect the learning process. Tables 5.11 and 5.12 show the distribution of textbook possession for Mathematics and English Language among respondents in the sample.

More than three quarters of respondents reported access to an English textbook. This includes those who would have rented their texts through the existing Secondary Schools Textbook Rental Programme, as well as

those who might have purchased the book.⁷ For Mathematics, some seventy nine percent of respondents reported possession of a textbook by either of the two means mentioned above, (Table 5.12).

TABLE 5.11 DISTRIBUTION OF STUDENTS BY ACCESS TO ENGLISH TEXTBOOK

	Frequency	Percent
YES	314	78.3
NO	87	21.7
TOTAL	401	100

TABLE 5.12 DISTRIBUTION OF STUDENTS BY ACCESS TO MATHEMATICS TEXTBOOK

	Frequency	Percent
YES	317	79.3
NO	83	20.8
TOTAL	400	100

A fractionally smaller proportion of students did not have Mathematics textbooks than was the case with English Language. Actually in many cases the same students had neither English nor Mathematics textbooks.

The reasons advanced for not having access to a textbook revolved principally around a lack of financial resources to purchase or rent them or, secondly, students stated that the book was not being used in classes.

With respect to the identification of factors which, in their view, adversely affected their ability to learn English and Mathematics, interestingly, respondents identified student related factors as being a principal area. These referred to aspects such as the students' mental retentive powers and are discussed more specifically

⁷ The Secondary Schools Textbook Rental Programme was inaugurated with funding by the Government of the United Kingdom and the Government of Jamaica to provide texts on rental to students in all public secondary institutions in Jamaica.

later.

TABLE 5.13 FACTORS PERCEIVED TO BE AFFECTING PERFORMANCE IN ENGLISH LANGUAGE

Factors	Frequency	Percent
TEACHER	26	7.0
STUDENT	121	32.4
RESOURCE GAPS	23	6.2
SCHOOL/CLASS	28	7.5
TEACHER/STUDENT	1	.3
SOCIO-LINGUISTIC	31	8.3
NONE	124	33.2
OTHER	30	5.1
TOTAL	403	100

The category teacher refers to the range of variables which students identified as affecting their performance and which could be construed to emanate from the teacher. This includes aspects such as teacher competence. Student factors include aspects such as the student's perception of the extent to which their learning the subjects was hampered by their own limitations. It is possible that greater probing could have elicited more information about the source of the problem. For example, when a student said: "I need to read more", was this indicative of the student's own distaste for reading or did it signify a lack of appropriate reading material? Resource gaps refer to areas where students identified either financial or material liabilities. School/class refers to aspects of the organisation of the school and/or classroom which the student identified as exerting a negative influence on their learning of English Language. These included: inadequate time allocated to teaching the subject; too large class sizes and the impact of undue and excessive noise in the learning environment. Socio-linguistic factors were taken to be those which alluded to the influence of the dialect and other environmental factors on their ability to learn standard English. Those who indicated that there was nothing which hampered their ability to learn English were also included for analysis because it was felt that the failure of a student to identify anything as adversely affecting the process of their learning English Language was itself of significance.

Those who failed to isolate a specific problem performed throughout the entire range of scores.

5.1.3 Student Achievement on The Tests

TABLE 5.14 SUMMARY OF ACHIEVEMENT ON ALL TESTS

Test	Valid Cases	Mean Score	Range
ENGLISH	394	45.5%	7%-83%
MATHEMATICS	394	41.1%	5%-87%
CREATIVITY 1	367	2.9	0-19
CREATIVITY 2	366	29.9	0-95
CRITICAL THINKING	219	0.9	0-15

From Table 5.14, we can see a summary description of the performance on each set of tests. Only scores for English and Mathematics are presented in percentage form. For the other tests, the raw scores are presented.

The frequency distributions of scores on all tests are represented graphically in Appendices 15 to 17.

The data will be presented to compare the scores recorded with each of the school types in the sample.

TABLE 5.15 DISTRIBUTION OF ENGLISH SCORES BY SCHOOL TYPE

Scores%	School Type				
	New Sec.	High	Tech.	Compr.	Total
80-99	0	2	1	0	3
60-79	2	70	8	5	85
40-59	42	87	18	13	160
20-39	83	31	11	8	133
0-19	8	3	0	2	13
TOTAL	135	193	38	28	394

Less than one percent of the sample received English scores in the fifth quintile (80-99) and among these, the largest proportion, two-thirds, represented students from

Secondary High schools, Table 5.15. No student from a Comprehensive High School or a New Secondary School gained scores in this range.

In the next category of scores, the fourth quintile, eighty two percent of cases were from the Secondary High Schools with New Secondary Schools registering only two percent. In categories 4 and 5, those receiving scores below 40%, New Secondary Schools registered the highest proportion of cases, with Technical High Schools recording the least.

Eighty-two percent of all cases from Secondary High Schools recorded scores of 40% and above. Forty percent of the entire sample obtained scores in this range. In New Secondary Schools, only thirty two percent of respondents had scores in that range.

**TABLE 5.16 DISTRIBUTION OF MATHEMATICS SCORES
BY SCHOOL TYPE**

Scores%	School Type				Total
	New Sec.	High	Tech.	Compr.	
80 - 99	0	9	1	0	10
60 - 79	2	44	9	4	59
40 - 59	22	78	12	7	119
20 - 39	99	55	14	14	182
0 - 19	14	6	2	2	24
TOTAL	137	192	38	27	394

For Mathematics, respondents from Secondary High Schools accounted for almost all scores above seventy nine percent. A student from a Technical High School was the only exception, Table 5.16.

Forty-eight percent of the sample obtained scores above forty percent in Mathematics. The scores of sixty-eight percent of respondents from Secondary High Schools were between forty percent and ninety percent. For respondents from New Secondary High Schools only eighteen percent obtained scores of forty percent or more for the Mathematics test. Fifty-two percent of respondents obtained scores of 0 to thirty-nine percent on the Mathematics test.

The scores on the Circles test were grouped so that 4

represented scores of 0 through 5; 3 indicated scores of 6 to 10; 2 meant scores of 11 through 15 and 1 signified scores of 16 and above. The distribution is shown in Table 5.17.

TABLE 5.17 DISTRIBUTION OF SCORES ON CIRCLES TEST BY SCHOOL TYPE

Scores	School Type				Total
	New Sec.	High	Tech.	Compr.	
1	0	1	1	0	2
2	0	23	3	0	26
3	9	29	7	4	49
4	118	124	26	22	290
TOTAL	127	177	37	26	367

Seventy-nine percent of all scores fell in category 4. This category accounted for the largest proportion of respondents from all school types. This category accounted for the scores of ninety three percent of all New Secondary respondents. The low scores recorded in this test were primarily due to the fact that the test was scored for originality hence many students who produced shapes which were common, received a score of 0 for their efforts. A Secondary High School and a Technical High School accounted for the only students who scored either 16 or above. Neither Comprehensive High Schools nor New Secondary Schools had any respondents gaining scores above 10.

The scores on the verbal creativity test, the Word Association Test, were grouped using the same categories as those employed for the Mathematics and English Tests except for the fact that scores on the verbal creativity test are not expressed in percentages.

Sixty-eight percent of all respondents, obtained scores of thirty nine or under. New Secondary students accounted for the highest single proportion in this category, with eighty two percent of all New Secondary respondents recording scores between 39 and 0.

Less than one percent of all respondents accounted for scores between 80 and 99. Only students who attended Secondary High Schools gained scores in this range.

TABLE 5.18 DISTRIBUTION OF SCORES ON WORD ASSOCIATION TEST BY SCHOOL TYPE

Scores	School Type				Total
	New Sec.	High	Tech.	Compr.	
80-99	0	3	0	0	3
60-79	2	13	1	2	18
40-59	21	63	8	4	96
20-39	39	60	11	12	122
0-19	66	43	10	8	127
TOTAL	128	182	30	26	366

The critical thinking or reasoning ability test scores were grouped in the following manner: 5, which refers to those who received 0 and which represented the largest number of cases ; 4, refers to respondents who received 1 and 2; 3 those who obtained 3 to 5; 2, those who attained 6 to 8 and 1, those who got 10 and above. Table 5.19 shows the distribution of scores on the Critical Thinking Test.

TABLE 5.19 DISTRIBUTION OF SCORES ON CRITICAL THINKING TEST BY SCHOOL TYPE

Scores	School Type				Total
	New Sec.	High	Tech.	Compr.	
1	0	7	0	0	7
2	0	3	0	1	4
3	3	14	2	0	19
4	4	10	5	2	21
5	53	91	12	12	168
TOTAL	60	125	19	15	219

The largest proportion of students of all school types obtained a score of 0 on this test. Some of the possible explanations for this have already been discussed. Of importance also, is that it was a test involving reading skills in addition to reasoning ability. The instructions were written and many respondents appeared to have totally misunderstood them and proceeded to support the arguments of the writer in equally emotive language rather than

weighing and assessing the merit and logical validity thereof.

Students from Secondary High Schools accounted for virtually all the scores in categories 1 and 2. One respondent from a Comprehensive High School constituted the only exception to this.

The distribution of scores on all of the tests according to the type of school which the students attend showed that for all tests, students of Secondary High Schools performed at a higher level than did students from any other type of secondary school. Only in the case of the two creativity tests and the critical thinking test did more than a half of the respondents from Secondary High schools register scores in the two lowest groups.

Students from New Secondary Schools performed worse than students of all other school types on all the tests. It was expected that this would not have necessarily been so with respect to the non-verbal creativity test. But, many New Secondary students apparently misunderstood the instructions which were written on that test and instead of producing drawings in which the circles were an integral part simple drew figures inside of the circles which did not incorporate the circles into the design.

Perhaps, a factor which may have had the greatest contribution on the low performance of New Secondary students, was the apparent and, in a few cases, stated poor reading skills. In all cases, instructions for the tests were written and the researcher tried not to depart in a verbal explanation, when requested, from the terms used in the written format.

5.2 Hypotheses Testing

It was advanced that this research project would, among other things, seek to identify the extent of the relationship, if any, between the scores on the five tests and a range of variables of interest. These include: the type of secondary school which the respondent attends; the gender composition of the school; the location of the school and the gender of the students. Cross-tabulation tables were done with each criterion variable measured against each variable of interest. The lambda measure of association was used to measure the extent of the relationship between all dependent variables and independent variables of interest, except in the case of the Critical Thinking test. This was done because all of the test scores except those of the Critical Thinking test were grouped prior to analysis, thus reducing them to the level of ordinal data. The lambda coefficient is said to

be the most reliable measure of association between a dependent ordinal variable and independent nominal variables. The eta coefficient of association was employed to measure the extent of the association between the scores on the Critical Thinking test and all of the variables of interest.

The distribution of scores on all tests on the basis of the gender of the respondent was of particular interest. T-tests were used to measure the differences, if any, in levels of achievement based on gender.

Having conducted these tests, the researcher felt, that it was necessary for the study to have some predictive value and to do so, some information about the nature of the relationship between the criterion or dependent variables and the variables of interest or independent variables was critical. This, it was felt was vital in order to inform decisions concerning educational policy. As a result of this, regression analysis was conducted using the test scores as criterion variables and the variables of interest as predictor variables.

5.2.1 The Extent Of Relationships

TABLE 5.20 COEFFICIENTS OF ASSOCIATION, LAMBDA/ETA OF ALL SCORES BY VARIABLES OF INTEREST

Scores	School Type	School Location	Gender Composition	Students' Sex
ENGLISH	.17521	.09402	.02991	.02564
MATHS	.10849	.00472	.12736	.00000
CIRCLES	.00000	.00000	.00000	.00000
WORD ASSOC.	.10460	.03347	.07950	.08368
CRITICAL THINKING	.20030	.10613	.08018	.00438

After doing cross-tabulation tables of each score against each independent variable, coefficients of association were calculated, lambda in the case of all tests except the critical thinking test where the eta coefficient was calculated. The resultant coefficients are illustrated in Table 5.20.

In all cases the lambda coefficient is close to 0

indicating that the variables of interest do not help significantly in predicting performance on all the tests for which it was applied. In the case of the non-verbal creativity test, the Circles Test, neither the type of school that a student attends, nor whether the school is located in an urban or a rural area, nor the gender composition of the school, nor the sex of the student doing the test seem to be of any value in predicting student performance.

Actually the fact that the respective lambda coefficients are close to 0 in most cases and 0 in one case, does not necessarily mean that there is no relationship between the variables. Such a relationship could be observed by examining the distribution of the dependent variable for each independent variable. An example of this kind of association is depicted in Table 5.21.

A kind of relationship can be observed in Table 5.21 in that the most frequently occurring score, zero, categorised in group 4, occurs most often for both urban and rural schools. This suggests that we could say that regardless of the location of the school attended, Jamaican secondary school students will demonstrate a low level of achievement on the non-verbal creativity test. Higher performance was associated with attendance in an urban school however. The extent to which these apparent associations are significant was tested further.

TABLE 5.21 DISTRIBUTION OF SCORES ON CIRCLES TEST BY SCHOOL LOCATION

Scores	Urban	Rural	Total
1	2	0	2
2	21	5	26
3	43	6	49
4	189	101	290
TOTAL	255	112	367

The differences in performance in all the tests which could be attributable to the sex of the student were tested more rigorously using the Students' t-test. The null hypotheses were that there would be no statistically significant differences between the means of the two populations (males and females) on any of the test scores. That is to say the average score for males and females on

all tests would be no different.

**TABLE 5.22 T-VALUES FOR ALL TEST SCORES
BY SEX OF STUDENT**

Test Scores	T-Value	Degrees of Freedom	2-Tail Prob.
ENGLISH	-.76	392	.451
MATHEMATICS	1.71	392	.088
CIRCLES	3.88	365	.000
WORD ASSOC.	-2.94	364	.003
CRITICAL THINKING	.06	217	.949

Table 5.22 summarises the results of the t-tests for each set of test scores by the sex of the student. For none of the scores except for both creativity tests, verbal and non-verbal did the results suggest that it was unlikely that males and females would perform similarly on the tests. To make a type 1 error as small as possible, an observed significance level of below .01 was employed in determining whether or not the sample variances in performance on all tests were similar. For the two tests mentioned before, the observed significance levels were .0005 in the case of the non-verbal test and, .003 in the case of the verbal creativity test. For all other tests the results suggest that it is likely that both males and females perform in the same way on the tests.

Efforts were made to test the hypotheses while controlling for other factors which could influence performance such as school type, school location and the gender composition of the school. Additional t-tests were conducted while isolating particular variables. For example, t-tests were conducted using performance on the tests from students who attended urban schools.

The test involving students from Secondary High Schools only, had a 2-tail probability of .001. This seems to suggest that for students attending Secondary High Schools the performance of both males and females on the non-verbal creativity test does not appear likely to be similar. A comparable result was obtained from the test which examined performance in urban schools and in co-educational schools. The observed significance levels were .0005 and .002 respectively. This seems to indicate that the likelihood exists that differences in performance of

students who attend co-educational schools and urban schools on the Circles test could be linked to the sex of the student. Performance in Mathematics for schools in urban areas produced an observed significance level of .011. The sex of a student therefore could be an important factor in explaining levels of achievement in Mathematics for students attending schools which are located in urban areas.

For those tests which generated observed significance levels which were too large to reject the null hypothesis, (Table 5.22) there remains the possibility that there are small differences in performance on those tests which could be linked to the sex of the student. In the case of English, there is a 45% chance that the t-value would be observed in a population in which males and females performed at comparable levels in English Language. For Mathematics, there is a 9% probability that the levels of achievement would be observed in a population in which there was no variation in performance which could be attributed to the sex of the student. The Critical Thinking test results suggest that there is a 95% chance of observing such a difference in achievement if levels of achievement on critical thinking were similar for males and females. This conclusion would have to be very tentatively expressed however in light of the problems with the test which have been previously outlined.

More rigorous testing of the hypothesis that there is no difference in levels of achievement in Mathematics and English Language based on the type of secondary school attended was done using the one-way analysis of variance. The data satisfied one of the preconditions for its use, that of randomness and the equal variance assumption held for the Mathematics and English Language tests. The F statistic for school type is highly significant, (.000) suggesting that the probability of F values of 49.127 is less than .0005 if the null hypothesis is true. Therefore the null hypothesis should be rejected. Students do not have the same average performance in English regardless of the type of secondary school which they attend. School type does influence levels of achievement in English Language.

In the case of the Mathematics test, the one-way analysis of variance, produced results which were similar to those generated by the English tests. The F value was 43.392 and the F statistics was .000. This suggests that the null hypothesis that the type of secondary school attended makes no difference to levels of achievement in Mathematics should be rejected. Hence students' performance in Mathematics is influenced by the type of school which the student attends. New Secondary school

students performed worse in both English Language and Mathematics with students of Secondary High Schools performing best.

5.3 The Nature Of The Relationship Between The Scores And Selected Variables

In order to identify which of the variables were most important in explaining variation in all the test scores, some regression analysis was conducted. A multiple regression model was developed to obtain that combination of variables which would best explain variance in students' levels of achievement in English Language, Mathematics, Creativity and Critical Thinking.

The variable age was added for analysis to determine the extent to which it helped to explain variation in performance on the tests. Two other variables were added for analysis. These were composites created from the survey data collected. One was an indicator of occupational status (occstat) created by averaging the occupational status of both parents/guardians where both existed or using the occupational level of one where only one was present in the household. The other was an indicator of educational status (edstat) created in the same manner as outlined above. Both were interpreted as indicators of the respondents' social and economic status. To facilitate analysis, several dummy variables were created: newschl = New Secondary Schools; sechigh = Secondary High Schools; techhi = Technical High Schools; singirl = Single Sex Girls' Schools; coschool = co-educational schools. The original variables school then became Comprehensive High Schools and gendcomp became single sex boys'schools. The full models contained the following variables with 'e' as the error term:

$$\begin{aligned} \text{English} &= \alpha + \beta_1 \text{schooltype} + \beta_2 \text{location} + \beta_3 \text{gendcomp} + \\ (Y_1) & \beta_4 \text{sex} + \beta_5 \text{occstat} + \beta_6 \text{edstat} + \beta_7 \text{age} + \beta_8 \\ & \text{newschl} + \beta_9 \text{techhi} + \beta_{10} \text{coschool} + \beta_{11} \text{sechigh} + \\ & \beta_{12} \text{singirl} + e. \end{aligned}$$

$$\begin{aligned} \text{Mathematics} &= \alpha + \beta_1 \text{schooltype} + \beta_2 \text{location} + \beta_3 \text{gendcomp} \\ (Y_2) & + \beta_4 \text{sex} + \beta_5 \text{occstat} + \beta_6 \text{edstat} + \beta_7 \text{age} + \beta_8 \\ & \text{newschl} + \beta_9 \text{techhi} + \beta_{10} \text{coschool} + \beta_{11} \text{singirl} + \\ & \beta_{12} \text{sechigh} + e. \end{aligned}$$

$$\begin{aligned} \text{Creativity 1} &= \alpha + \beta_1 \text{schooltype} + \beta_2 \text{location} + \beta_3 \\ (Y_3) & \text{gendcomp} + \beta_4 \text{sex} + \beta_5 \text{occstat} + \beta_6 \text{edstat} + \beta_7 \\ & \text{age} + \beta_8 \text{newschl} + \beta_9 \text{techhi} + \beta_{10} \text{coschool} + \beta_{11} \\ & \text{sechigh} + \beta_{12} \text{singirl} + e. \end{aligned}$$

$$\begin{aligned} \text{Creativity 2} &= \alpha + \beta_1 \text{ schooltype} + \beta_2 \text{ location} + \beta_3 \\ (Y_4) & \quad \text{gendcomp} + \beta_4 \text{ sex} + \beta_5 \text{ occstat} + \beta_6 \text{ edstat} + \\ & \beta_7 \text{ age} + \beta_8 \text{ newschl} + \beta_9 \text{ techhi} + \beta_{10} \text{ coschool} \\ & + \beta_{11} \text{ sechigh} + \beta_{12} \text{ singirl} + e. \end{aligned}$$

$$\begin{aligned} \text{Critical Thinking} &= \alpha + \beta_1 \text{ schooltype} + \beta_2 \text{ location} + \beta_3 \\ (Y_5) & \quad \text{gendcomp} + \beta_4 \text{ sex} + \beta_5 \text{ occstat} + \beta_6 \\ & \text{edstat} + \beta_7 \text{ age} + \beta_8 \text{ newschl} + \beta_9 \text{ techhi} + \\ & \beta_{10} \text{ coschool} + \beta_{11} \text{ sechigh} + \beta_{12} \\ & \text{singirl} + e. \end{aligned}$$

The decision to include the independent variables was made based on existing theoretical perspectives concerning some of the factors which can impinge on educational achievement. Studies in Jamaica have also identified several of the variables mentioned above as being related to academic achievement. The full models produced adjusted r^2 as identified in Table 5.23.

TABLE 5.23 REGRESSION COEFFICIENTS OF MULTIPLE DETERMINATION FOR FULL AND REDUCED MODELS ON ALL TESTS

Y-Values	Adjusted R Square Full Models	Adjusted R Square Reduced Models
ENGLISH	.35252	.35205
MATHEMATICS	.40592	.39553
CREATIVITY 1	.17922	.16309
CREATIVITY 2	.19231	.20375
CRITICAL THINKING	.10370	.13474

In an effort to try to incorporate those variables which best helped to explain variation in performance on the tests, and thus facilitate prediction, reduced models were calculated.

The variables which were retained in the reduced models were based principally on previous observation of the distribution of scores and analysis which indicated those which were associated with achievement levels in literacy, numeracy, creativity and critical thinking. In addition, examination of the t-values pointed to variables which contributed significantly to the observed variation in performance. For English all except New Secondary Schools (newschl) and Single Sex Girls' Schools (singirl) had t-values below a .01 level of significance. In the

case of New Secondary Schools however, Table 5.14, shows that attendance in New Secondary Schools was associated with low performance in English Language. Also much has been written about the facility which females often display with language, hence the retention of the singirl variable.

For Mathematics, the variables with significant t-values were location, Technical Schools (techhi), Secondary High Schools (sechigh) and Comprehensive Schools (school). Although New Secondary Schools and occupational status did not have significant t-values they were included in the reduced model because of observed contribution as well as theoretical perspectives.

A similar approach was adopted for the other three tests resulting in the following reduced models from stepwise procedures.

The reduced models were:

$$\text{English } (Y_1) = \alpha + \beta_1 \text{singirl} + \beta_2 \text{newschl} + \beta_3 \text{occstat} + \beta_4 \text{location} + e.$$

$$\text{Mathematics } (Y_2) = \alpha + \beta_1 \text{newschl} + \beta_2 \text{occstat} + \beta_3 \text{location} + \beta_4 \text{school} + e.$$

$$\text{Creativity 1 } (Y_3) = \alpha + \beta_1 \text{newschl} + \beta_2 \text{sex} + \beta_3 \text{school} + e.$$

$$\text{Creativity 2 } (Y_4) = \alpha + \beta_1 \text{sechigh} + \beta_2 \text{sex} + \beta_3 \text{singirl} + \beta_4 \text{newschl} + e.$$

$$\text{Critical Thinking } (Y_5) = \alpha + \beta_1 \text{occstat} + e.$$

To test whether or not the full models or the reduced models offered the best explanation of achievement differences in all the tests, the F-test for restrictions was calculated. Prior to this, however, the F-ratios were examined to establish that the variables did assist in explaining the variability of scores. The F-ratios for all scores were significant suggesting that all of the independent variables in the full models helped to explain student performance on all tests and appear to be related in a linear fashion to performance levels on the tests. The F ratios for all tests are shown in Table 5.24.

From Table 5.24, we can see that in none of the instances could the null hypothesis be rejected. That is, the variables which were omitted from the reduced model did not add significantly to explaining performance on any of the tests therefore the reduced model was better at explaining score variability than the respective full models.

TABLE 5.24 RESULTS OF F-TESTS OF EXISTENCE
AND RESTRICTIONS

	F-Ratio	F Calculated	F Critical $\alpha = .01$
ENGLISH	0.0000	1.10	2.51
MATHEMATICS	0.0000	2.26	2.51
CREATIVITY 1	0.0000	2.12	2.51
CREATIVITY 2	0.0000	0.80	2.51
CRITICAL THINKING	0.0098	0.74	2.18

Consideration of interaction effects was limited to performance in English Language and Mathematics. This was so because these were the principal variables of interest and time did not allow further analysis.

For this analysis two new variables were computed, for English $\beta_{13} = \beta_1 * \beta_2$, that is a variable which would combine the effects of occupational level and the school type variable, that is, newschl. Theory suggests that students of lower socio-economic status tend to be concentrated in the least valued type of secondary level institution, the New Secondary School. For Mathematics a similar procedure was followed with the sole exception of the inclusion of an additional variable computed from the combining of the effects of occupational status and comprehensive school, $\beta_{14} = \beta_2 * \beta_4$. This produced two new full models including the interaction effects:

$$\text{English } (Y_1) = \alpha + \beta_1 \text{ newschl} + \beta_2 \text{ occstat} + \beta_3 \text{ location} + \beta_4 \text{ singirl} + \beta_{13} + e.$$

$$\text{Mathematics } (Y_2) = \alpha + \beta_1 \text{ newschl} + \beta_2 \text{ occstat} + \beta_3 \text{ location} + \beta_4 \text{ school} + \beta_{13} + \beta_{14} + e.$$

Partial F-tests were conducted to determine whether or not the impact of school type on levels of achievement in English Language and Mathematics varied with the level of the parents'/guardians' occupational status. The null hypotheses were: for English $H_0 \beta_{13} = 0$; for Mathematics, $H_0 \beta_{13} = \beta_{14} = 0$. Table 5.25 shows the results of these tests.

TABLE 5.25 RESULTS OF F-TESTS FOR INTERACTION EFFECTS

	F-Calculated	F-Critical $\alpha=.01$
ENGLISH	22.79	6.85
MATHEMATICS	3.96	6.64

For performance in English, the calculated F value was greater than the critical F value, (Table 5.25). The null hypothesis that the new full model including the interaction effects would not add to explaining variation in levels of achievement in English Language has to be rejected. The opposite was true for Mathematics where the calculated F value was less than the critical F value hence the null hypothesis could not be rejected in this instance. For English therefore occupational status is involved interactively with attendance at New Secondary Schools in contributing to levels of achievement. Occupational status influences achievement in English Language across school types.

The scores were then examined in relation to each other because correlation analysis had revealed a high level of correlation between scores. Theory also suggests that performance in Mathematics is associated with levels of achievement in English Language [Isaacs 1974].

TABLE 5.26 CORRELATION MATRIX SHOWING ASSOCIATION BETWEEN SCORES

	ENGSCORE	MTHSCORE	CIRCLES	ASSOC	LETTER
ENGSCORE	1.0000	.6031	.3461	.4292	.2748
MTHSCORE	.6031	1.0000	.4586	.2825	.1632
CIRCLES	.3461	.4586	1.0000	.3077	.2567
ASSOC	.4292	.2825	.3077	1.0000	
LETTER	.2748	.1632	.2567	.1030	1.0000

Figure 5.1 shows the correlation coefficients between all scores with the term 'letter' indicating the results pertaining to the critical thinking test. All except, the scores in critical thinking and the scores in mathematics and the word association test had 1-tailed significance levels of .001. The strongest linear relationship was evident between Mathematics and English Language scores, with the weakest being between scores in the critical thinking test and those in the non-verbal creativity test. There was no significant linear relationship between performance in critical thinking and either performance in

mathematics or in the verbal creativity test.

Performance of students on all tests, therefore, is related to their performance on others. Except for critical thinking in two instances, higher scores on any test are associated with higher scores on all other tests. Performance in Mathematics helped to explain some forty percent of the variation in levels of achievement in English, $r_2 = .40326$. When performance in the verbal creativity test and performance on the critical thinking test are added to the model a half of the observed variability in achievement levels in English is explained, $r_2 = .50285$, adjusted $r_2 = .49574$.

The critical variables in explaining variation in performance in Mathematics were performance in English and performance on the non-verbal creativity test. That model had an $r_2 = .51207$ and an adjusted $r_2 = .50916$. A student who performs well in Mathematics therefore is likely to be a high achiever in English Language and in non-verbal creativity.

5.4 The Other Perspective

Teachers and school administrators all conceded to awareness of, and concern for, improving levels of achievement in literacy and numeracy. Differences existed as to interpretations of causative factors and consequently of methods for alleviating or minimising the problem.

All teachers identified student related factors as principal contributors to low levels of achievement. Demotivation, poor reading skills, lack of parental guidance, low levels of concept formation were a few of the problems mentioned. Only two teachers mentioned inadequate training, competence and retention of teachers as a contributory factor. Yet, a half of the Mathematics and English teachers interviewed confessed to not having been trained to teach those particular subjects. English teachers of all school types cited the existence of the dialect and its central position in the speech pattern of students as an important factor affecting the development of facility in Standard English. Shortage of teaching materials and inadequate allocation of time for teaching were other shortcomings mentioned.

5.5. Summary Discussion of the Findings

The levels of achievement of the research sample of Jamaican secondary school students in literacy and numeracy fell below the performance recorded for CXC candidates in 1992. For English Language, 22% of the sample recorded scores of 60% and over while 18% obtained a similar level

in Mathematics. This is not surprising since the CXC does not measure as wide a range of abilities as this survey sought to do. Also, for the CXC, final scores are based on performance on two papers for each subject while this was not the case for this survey. Nonetheless as an attempt to measure the range of abilities across the range of public secondary institutions, the survey has assisted in offering insights into the dimensions of the problem and some of the possible contributory factors.

The critical variables influencing performance in English Language were: attendance in a New Secondary School, parents/guardians' occupational status, attendance in a school located in an urban area and attendance in a girls' school. Attendance in a New Secondary School was negatively associated with improved levels of achievement in English Language. A student from this type of school therefore was more likely to perform poorly in English Language than a student attending any other type of secondary school. On the other hand, students whose parents had higher occupational levels or who attended girls' schools or secondary schools in urban areas, were more likely to perform better in English. It should be noted that, the most important explanatory variables of performance in English Language were attendance in a school other than a New Secondary School and the occupational status of parents/guardians. These two served to explain 30% of the variation in levels of achievement in English, (adjusted $r_2 = .30062$).

Eighteen percent of all students obtained scores of 60% or more on the Mathematics test compared to 28% of candidates obtaining Grades 1 & 2 in CXC Mathematics in 1992. Students who attended New Secondary and Comprehensive High Schools had a greater probability of performing badly than students from any other type of secondary school. Improved levels of achievement in Mathematics were also associated with higher occupational levels of parents/guardians and attendance at schools located in urban areas. Of students who attended schools in urban areas however, males were likely to perform better at Mathematics than females, ($t = 2.56$, $p = .011$).

Thirty-two percent of all males in urban schools obtained scores of 60% or over in Mathematics. For females, the proportion was seventeen percent. More than twice as many males than females obtained scores of 80% and above.

Most students displayed a lack of originality on the non-verbal creativity test. This seems to suggest an inadequacy of inventiveness among Jamaican secondary school students. It may, however, be a spurious association, as

the conditions under which the tasks were performed, although untimed, may not have been conducive to creative expression. Students of New Secondary and Comprehensive High Schools exhibited less non-verbal creative skills than students of all other types of secondary schools. Males exhibited significantly higher levels of non-verbal creative skills than females.

The opposite was true of the verbal creativity test where females tended to attain higher levels of performance than males. Attendance at a Secondary High School and a Single Sex Girls' School was also associated with greater ideational fluency. Students who attended New Secondary Schools performed badly on this test also.

There was some association between the sex of the student and performance on the Critical Thinking test but the most powerful factor explaining levels of attainment on this test, was the occupational status of the students' parents/guardians.

SECTION 6

CONCLUSION

The principal concern of this investigation was to identify the current levels of achievement in Jamaican Grade 11 students in literacy (proxy measure English Language), numeracy (proxy measure Mathematics), creativity and critical thinking, variables identified as being vital in facilitating the kind of human development necessary for national competitiveness.

Allied to this was the attempt to isolate some of those factors which were of importance in explaining poor learning performance. In this respect, although the investigation employed measuring instruments which assessed achievement in terms of rank-order, and these are popularly employed throughout the education system in Jamaica, perhaps a plurality of instruments to capture the different ways in which excellence is expressed would have been more effective. Certainly Jamaicans have been noted for responding to real life crises in a creative way. Perhaps creative responses were not forthcoming to the Circles test since it was not deemed to be crucial to survival. Also any evaluation of competencies or proficiencies must be informed by current knowledge of the specific conditions which help to shape the particular environment. The impact which these have in mediating student performance is of

significance.

Educational development can either facilitate or stymie social development. The reverse is no less true. Declining or low standards of performance must cause disquiet. This is especially so in the context of the unprecedented pace and scale of change occurring as a result of the new technologies.

The findings indicate a relationship between the type of school, occupational status of parent, school location and literacy and numeracy levels. Of course, the occupational status of parent/guardian is closely related to the type of school which a person is likely to attend, with higher occupational levels being associated with attendance in a secondary high school and lower occupational levels being associated with attendance in a New Secondary School. Also the very conceptualisation of the Jamaican secondary education system has rested on an ideology of elitism and reflects and reinforces the social disparities and inequities which are evident in the wider Jamaican society. This is a context which predisposes elite groups to reproduce themselves within the society through access to and in some instances control of, the principal institutions of influence and power, including the education system.

The mastery of literacy and numeracy skills in the sample was shown to be fairly low especially in New Secondary Schools. This has implications for the programmatic content of the offerings of secondary schools. To the extent that teachers use principally didactic rather than creative methodologies, the classroom climate is unlikely to promote the kind of creativity and critical thinking which is needed for development.

There is the need to address the segmentation of the secondary system as a matter of urgency. This needs to be done in such a manner as to remove all structural impediments to students developing self-confidence and a sense of self worth. These include organisational factors such as the methods of selection of students for entry to secondary schools and their placement within the school. This investigation highlights the weaknesses in the system generally and in New Secondary schools in particular.

No improvement can occur in the output of the secondary system without serious attention being paid to teacher quality and remuneration. This also involves improved supervision of schools and classrooms.

6.1 Recommendations

The following recommendations emanate from this investigation:

1. This study represents an initial attempt at developing a methodology for the regular collection of data pertaining to the group of young people whose entry to the labour market is most imminent. Policy initiatives need to be taken to institutionalise this practice and to develop the instruments which will help to reveal the dimensions of the problem as well as to identify causative factors with greater precision. Collaborative effort between the Statistical Institute, the Planning Institute of Jamaica and the Jamaican Ministry of Education should be able to produce quality data to inform policy.
2. A reassessment of training programmes for teachers of English and Mathematics is needed to emphasise the insertion of experiential components in the learning situation and to provide the basis for targetted interventions for males in English and for females in Mathematics.
3. Greater articulation between the lower grades (7 - 9) and the upper grades (10 - 11) of secondary schools and between secondary schools and primary schools, the world of work and the society to ensure that schooling truly offers the enhanced life chances which many expect.
4. The forging of a national consensus about the purposes of education in general and secondary education in particular with regards to preparing persons for the world of work. The responsibilities of the school as well as the responsibilities of enterprises for specialised training must be clearly delineated to avoid an overlap of roles and the inappropriate allocation of scarce resources. Firms and organisations need to be prepared to provide on-the-job training for school leavers as well as to provide upgrading programmes for current employees who may not possess the requisite literacy/numeracy skills.
5. The identification and replication through the school system of the cultural patterns which are essentially Jamaican are of vital importance to developing the national confidence which is vital for development.
6. The full implementation of proposals made by Craig (1971) and others for the use of foreign language methodologies in the teaching of English to Jamaican students.

7. The removal of elitist ideology and structures in education including selection procedures, curricular offerings and evaluative mechanisms, to release the potential of all our children.

8. Attention must be paid to system gaps which aid in perpetuating uneven levels of achievement. These include,

a) the lack of competency standards for Grade 11 students.

b) the practice of automatic age promotion of students regardless of performance levels.

c) the lack of an effective programme to provide teachers who are equipped to assist with remediation in all schools at all grade levels.

9. Ensure that quality secondary schooling is accessible to all students regardless of socio-economic status. The implications of increased cost recovery programmes for national development needs to be studied carefully before implementation.

10. Parents'/guardians' need to demonstrate positive valuation of educational achievement to undermine the association between low achievement and low occupational status.

6.2 Suggested Future Research

1. Content analysis of the English and Mathematics test papers would offer additional insights into where gaps in competencies exist.

2. Further investigation into the obstacles which hamper effective policy implementation in education is vital.

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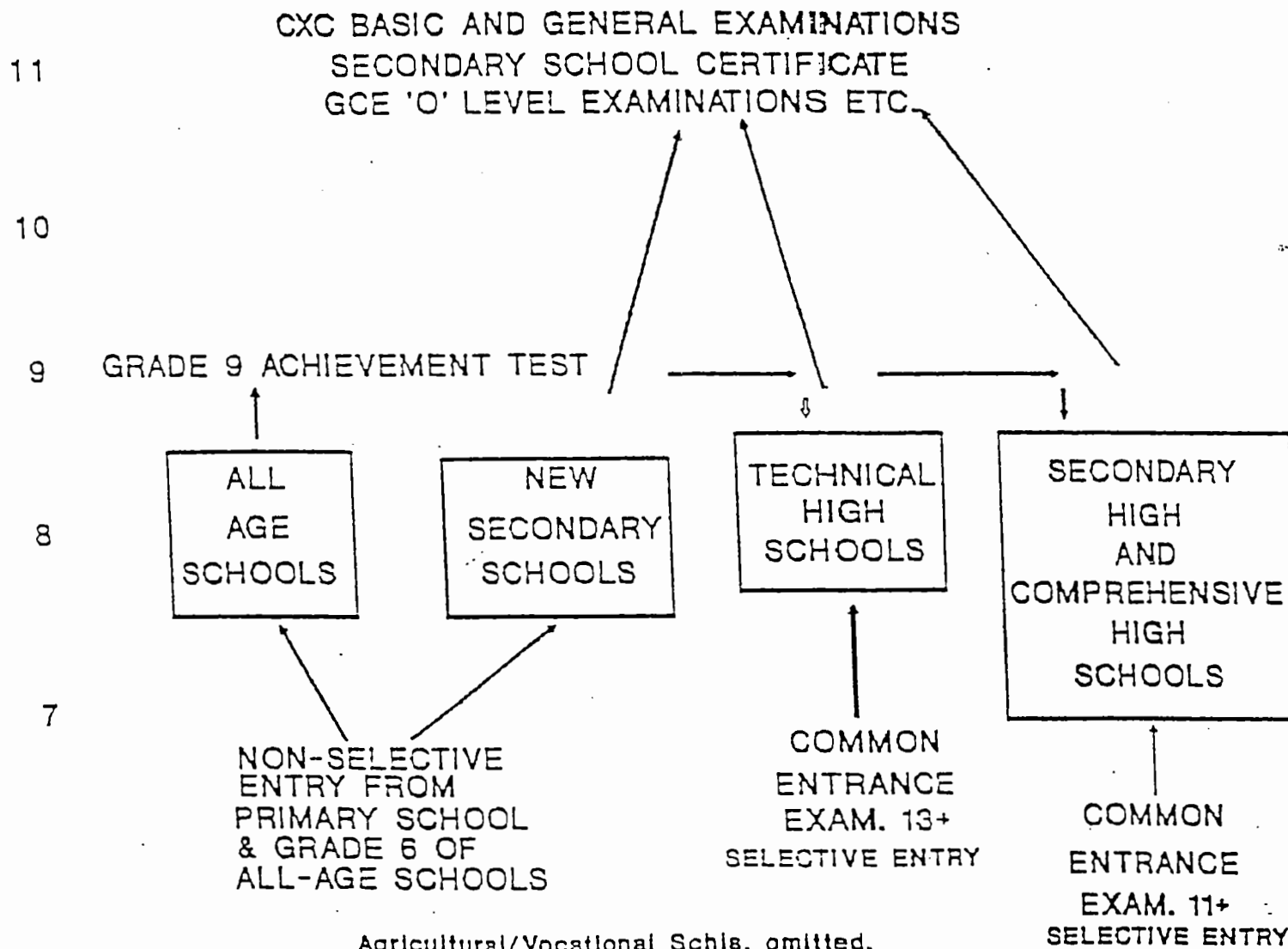
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APPENDIX I THE STRUCTURE OF THE JAMAICAN SECONDARY EDUCATION SYSTEM

GRADES



APPENDIX 2

THE URBAN/RURAL DISTRIBUTION OF SECONDARY SCHOOLS BY GENDER
COMPOSITION

SCHOOL TYPE	NUMBER
Urban Secondary High (Co-ed)	26
Urban Secondary High (Girls)	11
Urban Secondary High (Boys)	6
Urban New Secondary	33
Urban Comprehensive	7
Urban Technical	9
Rural Secondary High (Co-ed)	10
Rural Secondary High (Girls)	2
Rural Secondary High (Boys)	1
Rural New Secondary	24
Rural Comprehensive	6
Rural Technical	3

TOTAL 138

APPENDIX 3

INTERVIEW SCHEDULE

The purpose of this interview schedule is to obtain some information about you and your experiences with English Language and Mathematics. It is intended to assist a research project being conducted through the Consortium Graduate School at the U.W.I. Mona and which it is hoped will result in improvements in Language and Mathematics Education.

All information which you give will be treated confidentially.

1. What are the main subjects which you are now studying?

2. Which of these, if any, do you expect to sit in the Caribbean Examinations Council examinations?

3. Will you be sitting any in any other examination? If so, please specify.

4. On the scale below from 1 to 5 rate how you feel about learning English Language in school. Think of 1 as meaning that you do not like learning English Language at school and 5 as meaning that you like learning English Language at school very much.

1 2 3 4 5

5. On the scale below from 1 to 5 rate how you feel about learning Mathematics in school. Think of 1 as meaning that you do not like learning Mathematics at school and 5 as meaning that you like learning Mathematics at school very much.

1 2 3 4 5

APPENDIX 3 (contd.)

6. Does the way in which your English teacher teach the subject help you to understand English Language well?

YES [] NO []

7. If YES, specify two ways in which your teacher teaches which helps you to understand English.

8. If NO, suggest two ways in which your teacher could teach which would help you to understand English better.

9. Does the way in which your Mathematics teacher teaches help you to understand Mathematics well?

YES [] NO []

10. If YES, specify two ways in which your teacher teaches which helps you to understand Mathematics.

11. If NO, suggest two ways in which your teacher could teach which would help you to understand Mathematics.

12. Do you have an English Language textbook for your personal use?

YES [] NO []

13. If no, why not?

.....

14. Do you have a Mathematics textbook for your personal use?

YES [] NO []

15. If NO, why not?

.....

APPENDIX 3 (contd.)

16. On a scale of 1 to 5 in which 1 means Very Poor, 2 means Poor, 3 means Fair, 4 means Good and 5 means Very Good, how would you rate your performance in English Language?

 1 2 3 4 5

17. Using the scale designations outlined in the previous item, rate your performance of Mathematics.

 1 2 3 4 5

18. Please specify any other factors which, you think, may be adversely affecting how you learn English Language.

19. Please specify any other factors which may be adversely affecting how you learn Mathematics.

20. What is the main occupation of your mother/female guardian?

Top Management.....
 Professional/Technical.....
 Clerical.....
 Craft/Artisan.....
 Self-Employed.....
 Services.....
 Unemployed.....
 Other, Specify.....

21. What is the main occupation of your father/male guardian?

Top Management.....
 Professional/Technical.....
 Clerical.....
 Craft/Artisan.....
 Self-Employed.....
 Services.....
 Unemployed.....
 Other, Specify.....

APPENDIX 3 (contd.)

22. How many persons live at home with you, including parents/guardians?

23. Are any of the others working?

YES [] NO []

24. If YES, please state how many and specify their main occupation.

25. What is the highest education level attained by your mother/female guardian?

- No formal education.....
- Primary education
- Secondary education
- Tertiary education.....
- University education.....
- Don't Know.....

26. What is the highest level of education attained by your father/male guardian?

- No formal education.....
- Primary education.....
- Secondary education.....
- Tertiary education.....
- University education.....
- Don't Know.....

27. How old are you?

28. Sex?

MALE [] FEMALE []

SYNONYMS

Items 1 - 10

Directions: In each of the sentences given, there is one underlined word. Select the option which is nearest in meaning to the underlined word and mark the corresponding space on your answer sheet.

- The foreman said to the dock workers, "These Chinese vases are rather fragile, so handle them carefully."
- (A) expensive
(B) breakable
(C) important
(D) precious
2. Today many people are concerned about conserving energy.
- (A) saving
(B) discovering
(C) maintaining
(D) producing
3. There is no need to worry, as that decision can easily be revoked.
- (A) withdrawn
(B) justified
(C) reviewed
(D) mistaken
- The prisoner caused so much trouble that he was confined to his cell.
- (A) banished
(B) summoned
(C) condemned
(D) restricted
5. After a few days the drugs began to have an injurious effect on the addict's nervous system.
- (A) disagreeable
(B) unpredictable
(C) harmful
(D) permanent
6. Carelessness in the execution may easily spoil a well-planned piece of work.
- (A) sentence
(B) performance
(C) conclusion
(D) style
7. The policemen had difficulty apprehending the criminal who was armed.
- (A) solving
(B) approaching
(C) preventing
(D) attacking
8. The president, known for his popularity, had amassed considerable sums of money and property from his citizens.
- (A) popularity
(B) greed
(C) wisdom
(D) deception
9. Anyone with an artistic bent should do well in the advertising field.
- (A) design
(B) course
(C) taste
(D) inclination
10. The eminent detective worked on the case in his usual efficient manner.
- (A) superior
(B) capable
(C) distinguished
(D) notorious

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SPELLING

Items 11 - 20

Directions: In some of the following sentences one of the underlined words is misspelt. Choose from the three options, A, B, C, the word that is misspelt. If no word is misspelt choose answer D. Mark your choice on your answer sheet.

11. The man's dream of becoming a surgeon
A
was fulfiled because of his persistent
B C
effort. No error
D
12. All lilly formers in our school are studying
A B
hygiene. No error
C D
13. Many engineering schools are begining to
A B
accept female students. No error
C D
14. Practise for beginners in this course
A B
will commence at precisely ten o'clock.
C
No error
D
15. I bulleved that one of the men had a
A
moustache and a beard, and spoke with an
B
accent. No error
C D
16. This restuarant has been recommended to
A B
me by a friend who is acquainted with the
C
manager. No error
D
17. Misspelt words and incorrec grammer often
A B
prove embarrassing to those persons who
C
write articles for newspapers. No error
D
18. Excltment mounted as the wild creature,
A B
its tentacles raised, advanced to meet its
C
attacker. No error
D
19. The mischievous look on his face added to
A
the suspence which gripped the entire class.
B C
No error
D
20. "On the preceeding ocassion," the Opposi-
A B
tion Leader said to the Chief of Police,
"violence occurred because your officers
C
were negligent." No error
D

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PARAGRAPH ORGANIZATION

ITEMS 21 - 27

Items 21 - 24

Directions: Read the following paragraph. Then answer the items based on it.

¹ It was the second term at the Acadia Comprehensive School. ² As in the previous term, the food in the school cafeteria got worse and worse. ³ A first former then became ill. ⁴ The students refused to buy anything from the cafeteria and protested regularly and strongly. ⁵ The Headmaster was summoned when it became clearly obvious that the situation was becoming uncontrollable. ⁶ He arranged a meeting with the students and at that meeting decided to close the cafeteria until the following term. ⁷ The headmaster also told the students that nutritious food was necessary for success at examinations.

1. Which one of the following sentences contains the main idea developed in the paragraph?

- (A) Sentence 1
- (B) Sentence 2
- (C) Sentence 4
- (D) Sentence 7

22. Which one of the following sentences contains an example of redundancy?

- (A) Sentence 2
- (B) Sentence 4
- (C) Sentence 6
- (D) Sentence 8

23. The word "summoned" in Sentence 5 is nearest in meaning to

- (A) called
- (B) annoyed
- (C) warned
- (D) informed

24. Which one of the following sentences is NOT well connected with the main idea developed in the paragraph?

- (A) Sentence 1
- (B) Sentence 3
- (C) Sentence 5
- (D) Sentence 7

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APPENDIX 4 (contd.)

Items 25 - 27

Directions: Read the following paragraph. Then answer the Items based on it.

¹ In view of all this, his rivals had little chance of being selected Deputy Prime Minister. ² Sallim had everything in his favour. ³ As to his loyalty to the government, or, more specifically, the Prime Minister, there was no doubt of it. ⁴ He demonstrated it openly by often speaking publicly in support of the Prime Minister's policies. ⁵ The fact that Sallim was a Muslim was already an advantage. ⁶ And further, he was related to men of high influence. ⁷ Besides being a Muslim, he scored another point because he was a member of the Masonic Lodge.

25. Which one of the following sentences contains the main idea developed in the paragraph?

- (A) Sentence 1
- (B) Sentence 2
- (C) Sentence 3
- (D) Sentence 4

26. In Sentence 4, the word "openly" is closest in meaning to:

- (A) clearly
- (B) regularly
- (C) strongly
- (D) widely

27. Which one of the following sentences contains information already given in an earlier sentence?

- (A) Sentence 2
- (B) Sentence 4
- (C) Sentence 6
- (D) Sentence 7

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READING COMPREHENSION

ITEMS 20 - 00

Items 20 - 35

Directions: Read the following passage carefully. Then answer the items on the basis of what is stated or implied.

(5) Some farmers had not planted their yams yet. They were the lazy easy-going ones who always put off clearing their farms as long as they could. This year they were the wise ones. They sympathised with their neighbours with much shaking of the head, but inwardly they were happy for what they took to be their own foresight.

(10) Okonkwo planted what was left of his seed-yams when the rains finally returned. He had no consolation. The yams he had planted were the same as the harvest of the previous year. He still had the eight hundred from Nwakibia and the four hundred from his father's friend, so he would make a fresh start.

(20) But the year had gone mad. Rain fell as it had never fallen before. For days and nights together it poured down in violent torrents, and washed away the yam heaps. Trees were uprooted and deep gorges appeared everywhere. Then the rain became less violent. But it went on from day to day without a pause. The spell of sunshine which always came in the middle of the wet season did not appear. The yams put on luxuriant green leaves, but every farmer knew that without sunshine the tubers would not grow.

(30) That year the harvest was sad, like a funeral, and many farmers wept as they dug up the miserable and rotting yams. One man tied his cloth to a tree branch and hanged himself.

(35) Okonkwo remembered that tragic year with a cold shiver throughout the rest of his life. It always surprised him when he thought of it later that he did not sink under the load of despair. He knew he was a fierce fighter, but that year had been enough to break the heart of a lion.

20. The lazy farmers were saved because they

- (A) sympathised with the other farmers
- (B) knew the drought would come
- (C) had failed to plant their yams
- (D) were wiser than the other farmers

29. The farmers who were fortunate were happy because they

- (A) sympathised with their neighbours
- (B) had yams to give to their neighbours
- (C) had forecast a serious drought
- (D) had yams to give to their neighbours

30. Okonkwo was able to console himself because of the fact that he

- (A) owned land that was not affected by the heavy rain
- (B) had suffered as much as his neighbours
- (C) was able to sow yams before the drought
- (D) had yams left to make a fresh start

31. The year was said to have 'gone mad' (line 17) because

- (A) the farmers planted at different times
- (B) many farmers were angry at the weather
- (C) the pattern of the weather was unnatural
- (D) the rains washed away the yam heaps

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APPENDIX 4 (contd.)

32. The rain had all the following effects on the yams EXCEPT
- (A) the tubers did not grow to the desired size
 - (B) the yams put on brightly coloured leaves
 - (C) the yams were washed away
 - (D) the tubers could not be planted at the right time
33. By comparing the harvest to a funeral (lines 30 - 31) the author is suggesting that during the harvest
- (A) the yams were allowed to rot
 - (B) grief was experienced by many farmers
 - (C) farmers felt like committing suicide
 - (D) the miserable and rotting yams were buried
34. 'Okonkwo remembered . . . with a cold shiver' (lines 35 - 36) is nearest in meaning to
- (A) Okonkwo had a fearful feeling when he remembered that year
 - (B) Okonkwo recalled the year whenever the weather was cold
 - (C) Okonkwo remembered the year whenever he had a cold and was trembling
 - (D) Okonkwo would tremble whenever he was frightened
35. The impression of Okonkwo given in the passage is that he
- (A) is too dependant on his neighbours
 - (B) can survive great hardship
 - (C) can be very easily consoled
 - (D) is an easy-going person

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Items 36 - 45

Directions: Read the following passage carefully. Then answer the items on the basis of what is stated or implied.

(15) Kino and Juana came to the place where the brush houses stopped and the city of stone and plaster began, the city of harsh outer walls and inner cool gardens where a little water played and the bougainvillea crusted the walls with purple and brick-red and white. They heard from the secret gardens the singing of caged birds and heard the splash of cooling water on hot flagstones. The procession crossed the blinding plaza and passed in front of the church. It had grown now, and in the outskirts the hurrying newcomers were being softly informed how the baby had been stung by a scorpion, how the father and mother were taking it to the doctor.

(20) And the newcomers, particularly the beggars from the front of the church who were great experts in financial analysis, looked quickly at Juana's old blue skirt, saw the tears in her shawl, appraised the green ribbon on her braids, read the age of Kino's blanket and the thousand washings of his clothes, and set them down as poverty people and went along to see what kind of drama might develop. The four beggars in front of the church knew everything in the town. They were students of the expressions of young women as they went in to confession, and they saw them as they came out and read the nature of the sin. They knew every little scandal and some very big crimes. They slept at their posts in the shadow of the church so that no one crept in for consolation without their knowledge. And they knew the doctor. They knew his ignorance, his cruelty, his avarice, his appetites, his sins. They knew his clumsy abortions and the little brown pennies he gave sparingly for alms. They had seen his corpses go into the church. And, since early Mass was over and business was slow, they followed the procession, these endless searchers after perfect knowledge of their fellowmen, to see what the fat lazy doctor would do about an indigent baby with a scorpion bite.

(50) The scurrying procession came at last to the big gate in the wall of the doctor's house. They could hear the splashing of the water and the singing of caged birds and the sweep of the long brooms on the flagstones. And they could smell the frying of good bacon from the doctor's house.

(55) Kino hesitated a moment. This doctor was not of his people. This doctor was of a race which for nearly four hundred years had beaten and starved and robbed and displaced Kino's race, and frightened it too, so that the Indigene came hurribly to the door. And as always when he came near to one of this race, Kino felt weak and afraid and angry at the same time. Rage and terror went together. He could kill the doctor more easily than he could talk to him, for all of the doctor's race spoke to all of Kino's race as though they were simple animals. And as Kino raised his right hand to the iron ring knocker in the gate, rage swelled in him, and the pounding music of the enemy beat in his ears, and his lips drew tight against his teeth — but with his left hand he reached to take off his hat. The iron ring pounded against the gate. Kino took off his hat and stood waiting. Coyotito moaned a little in Juana's arms, and she spoke softly to him. The procession crowded close the better to see and hear.

36. In the passage the writer uses the phrase "harsh outer walls" (line 4) to show that

- (A) the walls were made of concrete
- (B) the poor people's houses had no walls
- (C) the city appeared unfriendly
- (D) there were gardens beyond the walls

GO ON TO THE NEXT PAGE

APPENDIX 4 (contd.)

37. The writer uses "secret" (line 8) to describe the gardens because

- (A) they were concealed
- (B) many treasures were hidden there
- (C) the occupants whispered there
- (D) many people did not know of them

38. The word "procession" (line 10) indicates that the crowd was

- (A) going to a funeral
- (B) moving in a long orderly group
- (C) walking together like a mob
- (D) moving about aimlessly

39. In the passage, "great experts in financial analysis" (line 19) means that the beggars

- (A) could immediately determine the rich from the poor
- (B) could analyse the financial state of the country
- (C) were able to add their alms quickly
- (D) had many years of experience in begging

40. All the following statements are true about the beggars EXCEPT that they

- (A) were inquisitive about people
- (B) knew about human nature
- (C) had a good relationship with the doctor
- (D) knew everything that went on around them

41. The description of the doctor's house in paragraph 3 (lines 48 - 55) conveys to the reader the impression of

- (A) comfort and prosperity
- (B) hard work and efficiency
- (C) happiness and love
- (D) fear and hatred

42. According to the passage, "Kino hesitated a moment" (line 56) because he

- (A) wondered whether he had enough money
- (B) wanted to kill the doctor
- (C) was afraid to approach the doctor
- (D) had to wait until the gate was opened

43. In the passage, the sentence, "His doctor was not of his people" (lines 58 - 59) means that the doctor

- (A) inspired fear and anger in Kino's people
- (B) was not born in the city as Kino was
- (C) did not understand Kino's people
- (D) came from a different culture to Kino's

44. Which one of the following statements most fully describes Kino's attitude at the moment described in (lines 69 - 75) "And as Kino raised his right hand but with his left hand reached to take off his hat"?

- (A) Kino was a very respectful person.
- (B) Kino was a murderer at heart.
- (C) Kino was an indecisive person.
- (D) Kino had conflicting emotions.

45. The passage illustrates all of the following EXCEPT

- (A) the suffering of Juana and Kino
- (B) the curiosity of the city people
- (C) the kindness of the beggars
- (D) the contrast between the rich and the poor

APPENDIX 4 (contd.)

Items 46 - 54

Directions: Read the following passage carefully. Then answer the items on the basis of what is stated or implied.

The depths of the ocean are as secret, unexplored, and challenging as the vast distances of outer space. The surface of the moon is far better known than the floor of the Atlantic. But here, again, man is catching up with his mysterious inheritance. The voyage of "Nautilus" in 1959 was, perhaps, only a first elementary voyage of discovery into the deep vastness of the oceans of the world. The science of oceanography already foresees the day when we may travel as easily below as on the surface of the water; and it is not too fantastic to suppose that the aeroplane may eventually be superseded by the submarine liners as the safest form of world travel.

It is fascinating to speculate upon the mass of material on the oceans' floors. In those deep, silent dungeons, what startling facts could be brought to light. What treasure for the historian and geologist!

Practical man, however, regards the oceans as ample providers of food in a world of growing population. The sea is a colossal provider of food, particularly protein, so urgently needed by countless thousands of undernourished people. Biologists believe that the exploration of the sea is still at quite a primitive stage. The travelling fishing fleets are comparable to tribes of nomadic hunters, killing food where they find it, with no thought of conserving supplies for future generations. Modern trawlers indiscriminately scoop up vast quantities of immature fish, and there is a danger of many once-abundant fishing grounds being turned into the marine equivalent of a dust-bowl. If the fishing industries of nations were better controlled, the abundant supply of fish would be ensured. Scientists are only now beginning to realise the vast advantages of study and research. For example, control of the starfish population, which consumes 98%

of the protein, under the sea, would lead to spectacular results in the quality and quantity of the fish we need.

46. The writer refers to the ocean as "mysterious" (line 6) because

- (A) man does not know what secrets lie within it
- (B) modern scientists, historians and geologists are fascinated by it
- (C) it contains many varied and beautiful creatures
- (D) man has been unwilling and afraid to explore its secret depths

47. The reference to the voyage of "Nautilus" (line 7) is meant to

- (A) describe an undersea voyage
- (B) lead up to the problems of undersea exploration
- (C) inform the readers that great discoveries have been made
- (D) indicate how little exploration has taken place

48. The main intention of paragraph one (lines 1 - 17) is to

- (A) hint at the possibilities of ocean exploration
- (B) show how uninterested man is in the oceans
- (C) give details about travel in the oceans
- (D) indicate that man would be better off exploring the oceans rather than outer space

APPENDIX 4 (contd.)

49. The comparison of the oceans' floors to "silent dungeons" (line 20) suggests that

- (A) the oceans' floors are sinister and restricting
- (B) the oceans' floors are relatively undisturbed and conceal much information
- (C) it is possible to penetrate the depths of the ocean without loss of life
- (D) It is unlikely that the vast depths of the oceans' floors can be fully explored

50. According to the passage, the first step to be taken in harnessing the potential of the ocean is to

- (A) control the starfish population
- (B) improve fishing practices
- (C) increase scientific exploration and research
- (D) develop its protein resources

51. The writer believes that the ocean should be of great interest to mankind because

- (A) it will become the shortest way of travel
- (B) it has unlimited potential for the provision of food
- (C) the exploration of outer space no longer holds an attraction for mankind
- (D) its depths are secret and unexplored

52. From the statements listed below, select the one which is NOT suggested by the writer.

- (A) Control of the world's fishing is necessary;
- (B) The ocean is rich in protein.
- (C) New fishing techniques are being developed.
- (D) The ocean is being explored.

53. The writer regards present trawler fishing techniques as

- (A) a necessary evil
- (B) too concerned with exploration
- (C) modern in their operation
- (D) wasteful of ocean life

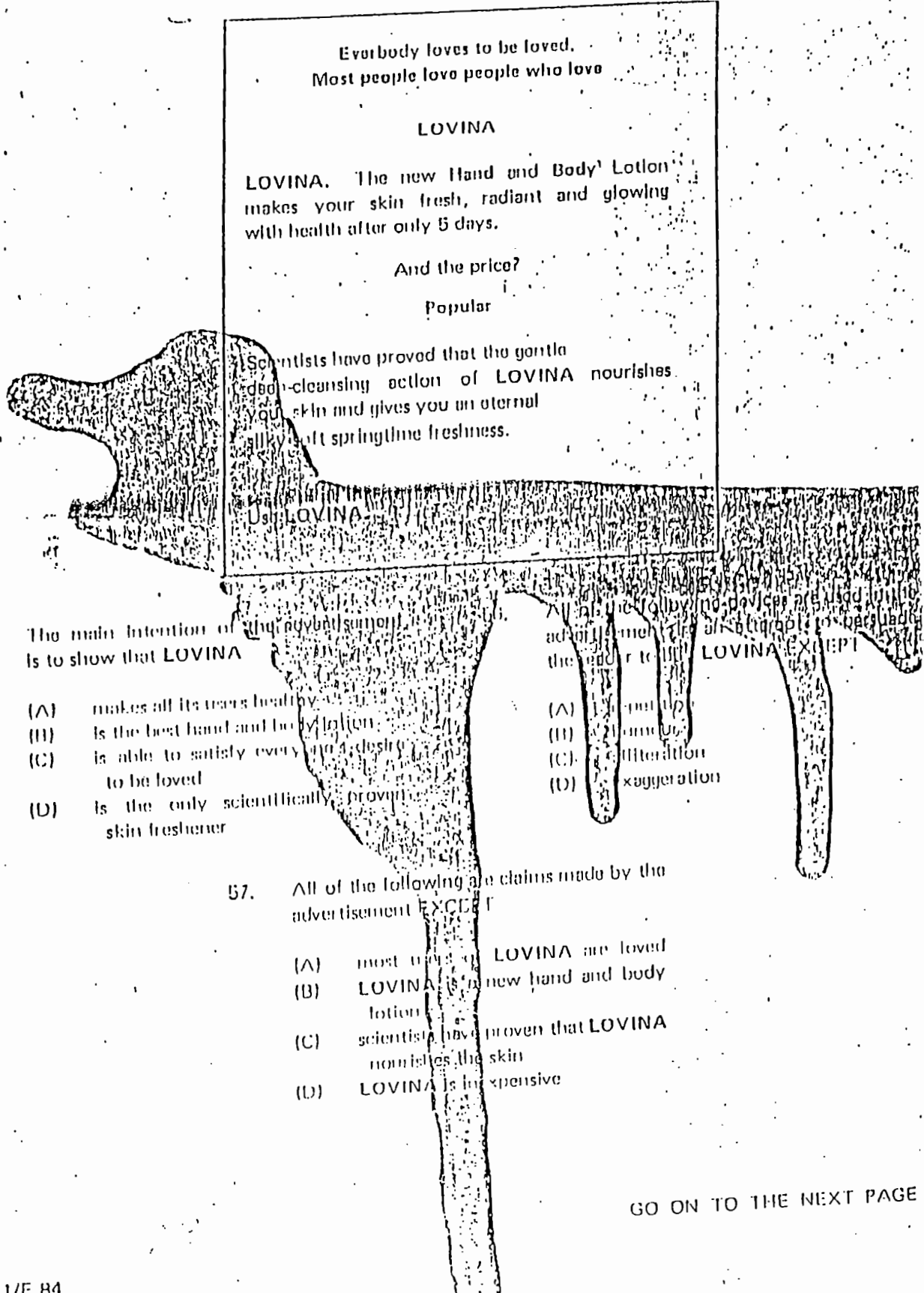
54. This passage

- (A) is a warning about the dangers of ocean travel
- (B) is a warning about the dangers of ocean fishing
- (C) is a warning about the dangers of ocean exploration
- (D) is a warning about the dangers of ocean research

APPENDIX 4 (contd.)

Items 55 - 57

Directions: Read the following advertisement carefully. Then answer the items based on what is stated or implied.



Everybody loves to be loved.
Most people love people who love

LOVINA

LOVINA. The new Hand and Body Lotion makes your skin fresh, radiant and glowing with health after only 5 days.

And the price?

Popular

Scientists have proved that the gentle
foam-cleansing action of LOVINA nourishes
your skin and gives you an eternal
soft springtime freshness.

Use LOVINA

55. The main intention of the advertisement is to show that LOVINA

- (A) makes all its users healthy
- (B) is the best hand and body lotion
- (C) is able to satisfy every one's desire to be loved
- (D) is the only scientifically proven skin freshener

All of the following are claims made by the advertisement EXCEPT

- (A) most people who use LOVINA are loved
- (B) LOVINA is a new hand and body lotion
- (C) scientists have proven that LOVINA nourishes the skin
- (D) LOVINA is inexpensive

57. All of the following are claims made by the advertisement EXCEPT

- (A) most people who use LOVINA are loved
- (B) LOVINA is a new hand and body lotion
- (C) scientists have proven that LOVINA nourishes the skin
- (D) LOVINA is inexpensive

GO ON TO THE NEXT PAGE

Items 58 - 60

Directions: Read the following advertisement carefully. Then answer the items based on what is stated or implied.

FEELING TIRED?
PEP UP AND COME ALIVE WITH
VIVATONE TONIC WINE
USED BY WINNERS EVERYWHERE
VIVATONE! THE LIFE-GIVING DRINK!
VIVATONE!

58. The advertisement is appealing mainly to

- (A) social climbers
- (B) drunkards
- (C) weary people
- (D) athletes

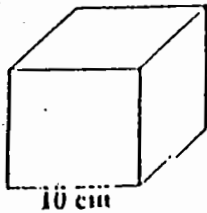
59. The advertiser uses the name VIVATONE to suggest

- (A) energy
- (B) ambition
- (C) diligence
- (D) success

60. Which one of the following devices does the writer make use of in the passage to try to persuade the reader to buy VIVATONE?

- (A) simile
- (B) irony
- (C) personification
- (D) repetition

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.



1. The volume of the cube above is

- (A) 30 cm^3
- (B) 100 cm^3
- (C) 300 cm^3
- (D) $1\,000 \text{ cm}^3$

2. The value of 2 in the number 425.3 is

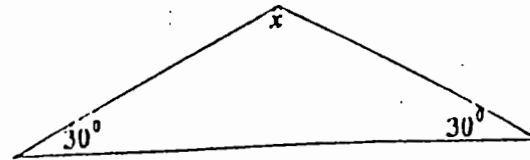
- (A) 2 tenths
- (B) 2 ones
- (C) 2 tens
- (D) 2 hundreds

3. 0.45 as a fraction is

- (A) $\frac{9}{20}$
- (B) $\frac{4}{5}$
- (C) $\frac{9}{10}$
- (D) $\frac{5}{4}$

4. In which of the following are the fractions arranged from the smallest to the greatest?

- (A) $(\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5})$
- (B) $(\frac{1}{2}, \frac{1}{4}, \frac{1}{3}, \frac{1}{5})$
- (C) $(\frac{1}{5}, \frac{1}{4}, \frac{1}{3}, \frac{1}{2})$
- (D) $(\frac{1}{5}, \frac{1}{3}, \frac{1}{4}, \frac{1}{2})$



5. In the triangle above, what is the value of x ?

- (A) 30°
- (B) 60°
- (C) 120°
- (D) 150°

6. $3\frac{1}{4} \times 2\frac{2}{5} =$

- (A) 6
- (B) $6\frac{6}{20}$
- (C) $6\frac{5}{9}$
- (D) 9

7. What is the smallest number of children that can be put into equal teams of 3, 4 or 6?

- (A) 6
- (B) 12
- (C) 13
- (D) 72

8. If $75 = 5 + (10 \times N)$, then $N =$

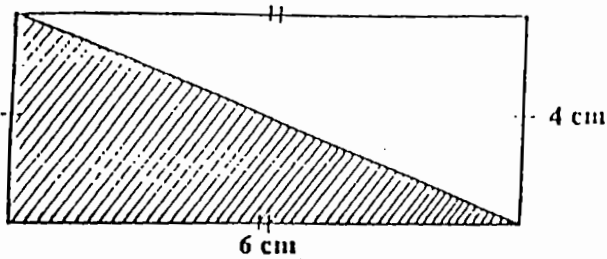
- (A) 7
- (B) 10
- (C) 15
- (D) 70

9. Which of the following words BEST describe a quadrilateral with all its sides equal?

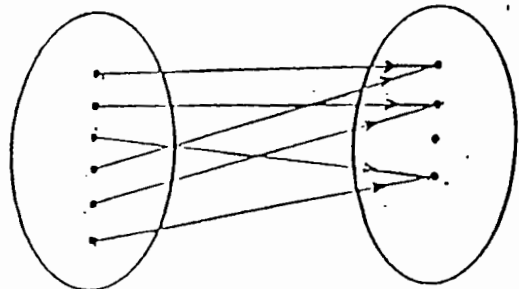
- (A) Rhombus
- (B) Rectangle
- (C) Parallelogram
- (D) Trapezium

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APPENDIX 5 (contd.)



10. The area of the shaded part of the rectangle above is
- (A) $(6 + 4) \text{ cm}^2$
 (B) $\frac{(6 \times 4)}{2} \text{ cm}^2$
 (C) $(4 + 6 + 4 + 6) \text{ cm}^2$
 (D) $(6 \times 4) \text{ cm}^2$
11. Which of the following would be MOST suitable for displaying the proportions of a country's budget spent on different departments?
- (A) Pie chart
 (B) Bar chart
 (C) Line graph
 (D) Histogram
12. Which of the following is a prime number?
- (A) 252
 (B) 255
 (C) 257
 (D) 261
13. What is the perimeter of the shape above?
- (A) 24 cm
 (B) 26 cm
 (C) 28 cm
 (D) 48 cm
14. What is the value of $2x^2$ when $x = -3$?
- (A) -12
 (B) -6
 (C) 18
 (D) 36
15. In a school 55% of the students are boys. There are 495 boys. The number of girls in the school is
- (A) 45
 (B) 90
 (C) 405
 (D) 445
16. If $p * q$ means $(p^2 - q^2)$, then the value of $10 * 6$ is
- (A) 4
 (B) 8
 (C) 16
 (D) 64
17. All students in a class play Scrabble or Checkers or both. 36% of the students play Scrabble only; 48% of the students play Checkers only. What percentage of students play both games?
- (A) 12
 (B) 16
 (C) 84
 (D) 88
18. Mr. Duncan bought a table at a discount of 30% thus saving \$42. The original price of the table was
- (A) \$ 98
 (B) \$110
 (C) \$140
 (D) \$182
19. The relationship that BEST describes the mapping in the above diagram is
- (A) one-to-one
 (B) one-to-many
 (C) many-to-one
 (D) many-to-many



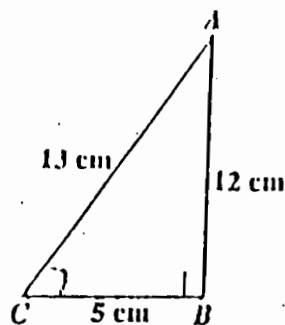
APPENDIX 5 (contd.)

20. The number 4760 written in standard form is

(A) 0.4760×10^4
 (B) 4.760×10^3
 (C) 47.60×10^2
 (D) 4.760×10^1

21. In a class of 20 students, 12 are girls. What is the probability that a student chosen at random is a boy?

(A) $\frac{1}{20}$
 (B) $\frac{8}{20}$
 (C) $\frac{12}{20}$
 (D) $\frac{8}{12}$



22. In triangle
- ABC
- above,
- $AB = 12$
- cm,
- $AC = 13$
- cm and
- $BC = 5$
- cm. What is the value of
- $\tan C$
- ?

(A) $\frac{5}{13}$
 (B) $\frac{12}{13}$
 (C) $\frac{12}{5}$
 (D) $\frac{13}{5}$

- 23.
- $3x - 2xy + 5xy - x =$

(A) $5xy$
 (B) $2x + 3xy$
 (C) $4x + 7xy$
 (D) $11xy$

24. I gave
- $\frac{2}{3}$
- of my salary to Joan and
- $\frac{1}{4}$
- to P. I had \$120 left. How much was my salary?

(A) \$ 240
 (B) \$ 360
 (C) \$ 960
 (D) \$1440

Items 25 - 26 refer to the table below.

Electricity charges me as follows:

First 100 units	13 cents per unit
Next 100 units	10 cents per unit
Units over 200	5 cents per unit

25. In April Mary used 455 units. How much she pay?

(A) \$22.75
 (B) \$35.75
 (C) \$45.50
 (D) \$59.15

26. Mary's bill for May was \$28.00. The number of units she used was

(A) 200
 (B) 280
 (C) 300
 (D) 350

27. If
- $4.3 \times 0.37 = 1.591$
- , then
- 0.43×370

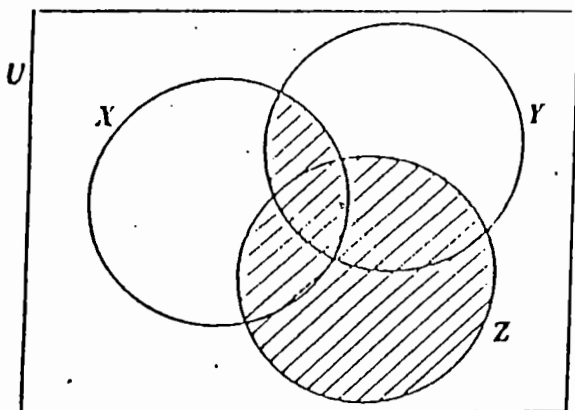
(A) 1.591
 (B) 15.91
 (C) 159.1
 (D) 1591.0

APPENDIX 5 (contd.)

28. If the universal set is the set of all counting numbers less than 10, and $L' = \{2, 4, 5, 6, 7, 8\}$ then $L =$

- (A) $\{2, 4, 6, 8\}$
 (B) $\{5, 7\}$
 (C) $\{1, 3, 9\}$
 (D) $\{6\}$

29. Which of the following line graphs represents $\{x : -2 < x \leq 4\}$?

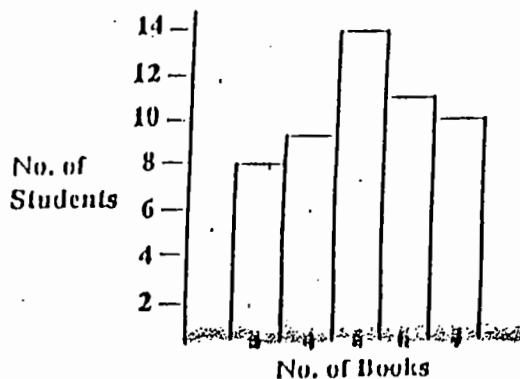


30. In the Venn diagram above, the shaded portion represents

- (A) $(X \cap Z) \cup Y$
 (B) $(X \cap Y) \cup Z$
 (C) $(X \cup Y) \cap Z$
 (D) $(Y \cap Z) \cup X$

Items 31 - 33 refer to the following information.

A survey was carried out to find out the number of books first form students bought. The results are given in the bar chart below.



31. How many children bought exactly 4 books?

- (A) 8
 (B) 9
 (C) 10
 (D) 14

32. What is the mode of the distribution?

- (A) 3
 (B) 5
 (C) 7
 (D) 14

33. How many children took part in the survey?

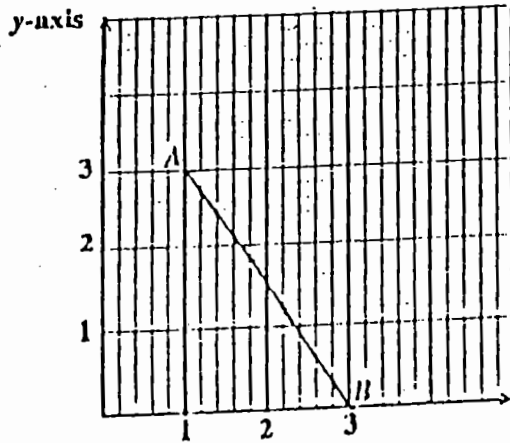
- (A) 14
 (B) 25
 (C) 52
 (D) 56

APPENDIX 5 (contd.)

34. A small aircraft left Trinidad on Monday at 23:00 hours. It arrived in Tortola on Tuesday at 03:00 hours. How long (in hours) did the flight take?

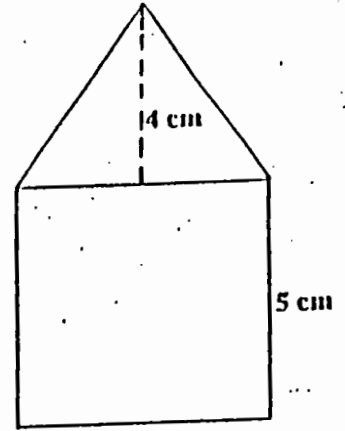
- (A) 4 hrs
 (B) 20 hrs
 (C) 26 hrs
 (D) 52 hrs

Items 35 - 37 refer to the diagram below.



35. The coordinates of the point A are
- (A) (3, 0)
 (B) (3, 1)
 (C) (0, 3)
 (D) (1, 3)
36. The gradient of AB is
- (A) $-\frac{3}{2}$
 (B) $-\frac{2}{3}$
 (C) $\frac{2}{3}$
 (D) $\frac{3}{2}$
37. If BA is produced, it will cut the y-axis at the point
- (A) (0, 4)
 (B) $(0, 4\frac{1}{2})$
 (C) (0, 5)
 (D) $(0, 5\frac{1}{2})$

38. The angles of a quadrilateral are in the ratio 1 : 2 : 3 : 4. The size of the largest angle is
- (A) 36°
 (B) 72°
 (C) 90°
 (D) 144°



39. The figure above, not drawn to scale, consists of a triangle resting on a square of side 5 cm. The height of the triangle is 4 cm. What is the total area of the figure?
- (A) 35 cm^2
 (B) 45 cm^2
 (C) 50 cm^2
 (D) 100 cm^2
40. The number 324_5 converted to base 10 is
- (A) 9
 (B) 45
 (C) 89
 (D) 95
41. Think of a number. Subtract 8 from it. Multiply the difference by 3. The result is 21. What was the original number?
- (A) 1
 (B) 3
 (C) 10
 (D) 15

42. A plot of land is valued at \$18 000. Land tax is charged at the rate of \$0.70 per \$100. What is the total amount of tax paid for the land?
- (A) \$110.00
 (B) \$126.00
 (C) \$180.70
 (D) \$257.15

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APPENDIX 5 (contd.)

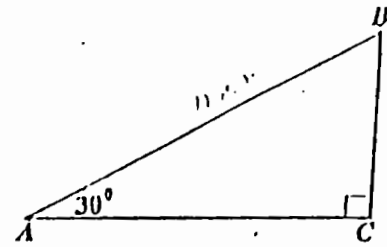
43. $\frac{x}{2} + \frac{2}{x} =$

(A) $\frac{x+2}{2x}$

(B) $\frac{x^2+2}{2}$

(C) $\frac{x^2+4}{2x}$

(D) $\frac{x+2}{2+x}$

44. Which of the following sets is represented by the relation $f: x \rightarrow x^2 + 3$?

(A) $\{(0, 3), (1, 4), (2, 7), (3, 12)\}$

(B) $\{(0, 3), (1, 5), (2, 7), (3, 9)\}$

(C) $\{(0, 3), (1, 4), (2, 5), (3, 6)\}$

(D) $\{(0, 3), (1, 1), (2, 4), (3, 9)\}$

45. Mary is x years old now, her brother's age is three times hers. Her brother's age in five years time will be

(A) $3x + 5$

(B) $3(x + 5)$

(C) $x + 3 + 5$

(D) $3(5x)$

46. $(3x - 2)(x + 1) =$

(A) $3x^2 - x - 2$

(B) $3x^2 - x + 2$

(C) $3x^2 + x - 2$

(D) $3x^2 + x + 2$

47. At a sale, the price of EACH dress on a certain rack was reduced by \$30.00. A customer paid \$160.00 for 2 dresses that had the same original selling price. What was the original selling price of ONE of the dresses?

(A) \$200.00

(B) \$215.00

(C) \$245.00

(D) \$260.00

48. In the triangle ABC above, not drawn to scale, A is 30° and $AB = 40$ m. The length of BC , in metres, is

(A) $40 \tan 30^\circ$

(B) $40 \sin 30^\circ$

(C) $40 \sin 60^\circ$

(D) $40 \tan 60^\circ$

49. The marked price of a table was \$100. The price was increased by 10% and then later decreased by 10%. The final selling price of the table was

(A) \$ 99

(B) \$100

(C) \$110

(D) \$120

50. Twice the square root of x may be written as

(A) $2\sqrt{x}$

(B) $\sqrt{2x}$

(C) $\sqrt{2x}$

(D) $\sqrt{x}\sqrt{x}$

51. Althea saves \$ x each month; but in May she saved \$4 more than twice her regular amount. In May she saved

(A) \$ $1x$

(B) \$ $6x$

(C) \$ $(x + 4)$

(D) \$ $(2x + 4)$

52. An article cost \$4.40. It was sold for \$5.50. The gain per cent on the cost price was

(A) 10%

(B) 20%

(C) 25%

(D) 80%

APPENDIX 5 (contd.)

53. The arithmetic mean of 5 numbers is 65 and the first four numbers are 87, 73, 34, 48. The remaining number is

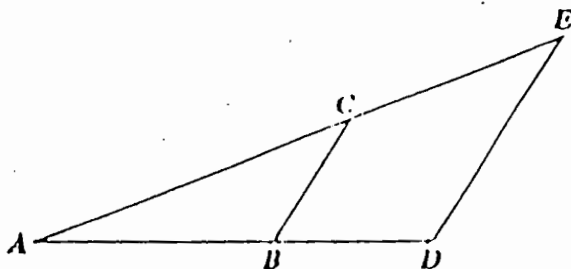
(A) 59
(B) 83
(C) 92

54. A car presently valued at \$12 000 depreciates at the rate of 10% per annum. What will be its value one year later?

(A) \$10 800
(B) \$11 800
(C) \$11 880
(D) \$11 990

55. The simple interest on \$15 000 for three months at 10% per annum is

(A) \$ 375
(B) \$ 500
(C) \$1500
(D) \$-1500

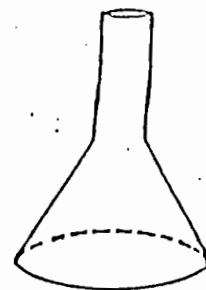


56. In the figure above, triangle ABC is enlarged from centre A by a scale factor 2 to produce triangle ADE . If the area of ABC is 20 cm^2 , then the area of ADE is

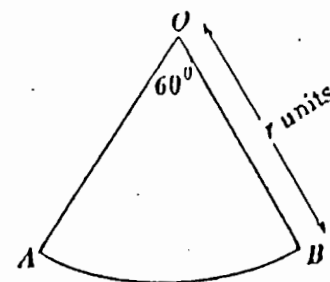
(A) 10 cm^2
(B) 40 cm^2
(C) 60 cm^2
(D) 80 cm^2

57. The sum of three of the interior angles of a convex pentagon is 420° . If the remaining angles are equal, what is the size of each remaining angle?

(A) 60°
(B) 90°
(C) 108°
(D) 108°



58. The plan of the funnel shown in the figure above is



59. AOB is a sector of a circle such that angle $AOB = 60^\circ$ and OB is r units long. The arc of AOB is

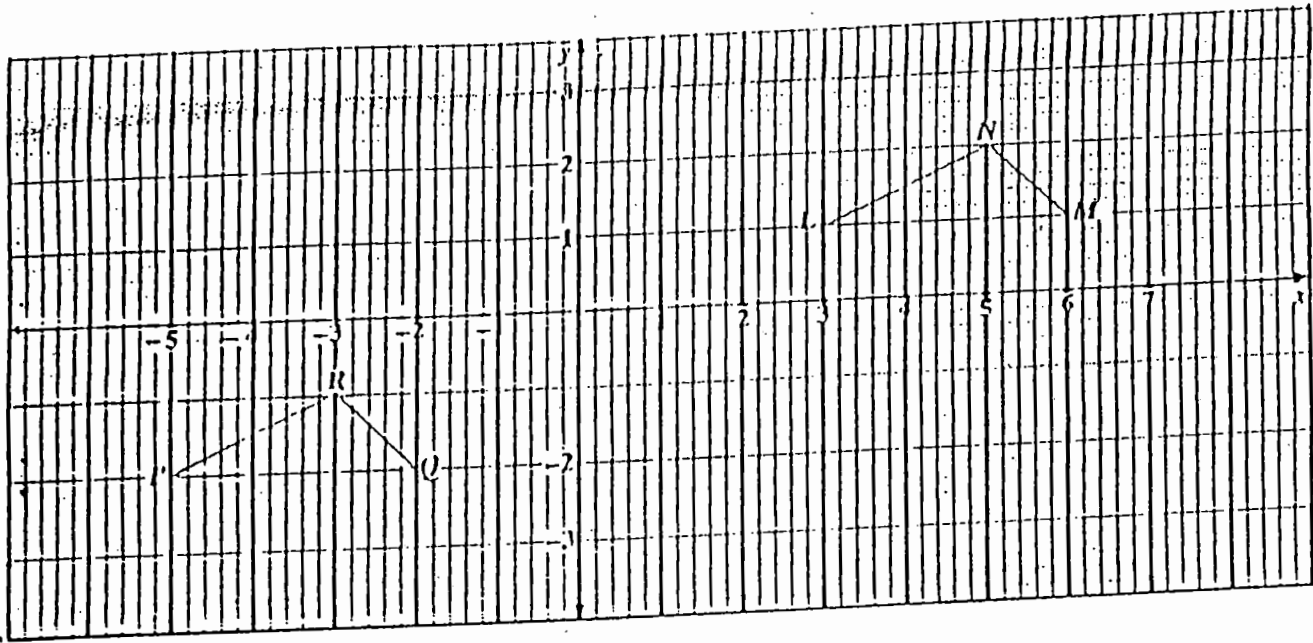
(A) $\frac{1}{6}\pi r$

(B) $\frac{1}{3}\pi r$

(C) $\frac{1}{6}\pi r^2$

(D) $\frac{1}{3}\pi r^2$

APPENDIX 5 (contd.)



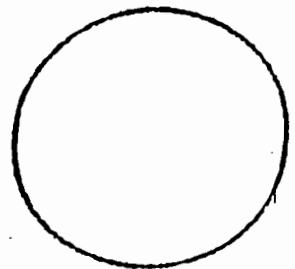
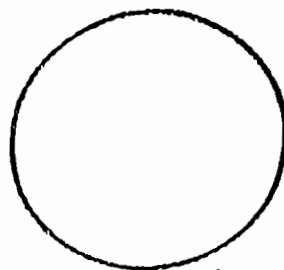
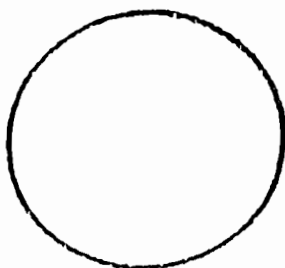
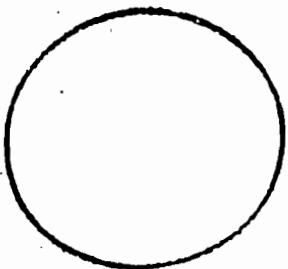
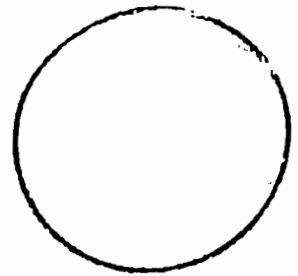
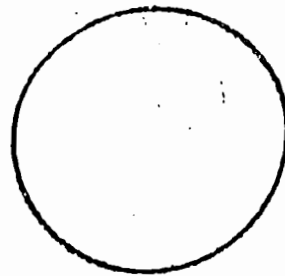
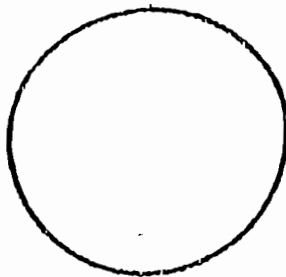
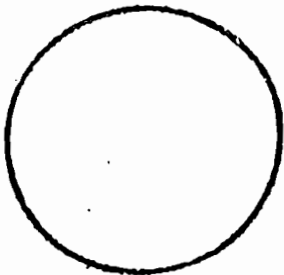
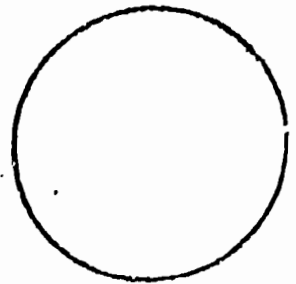
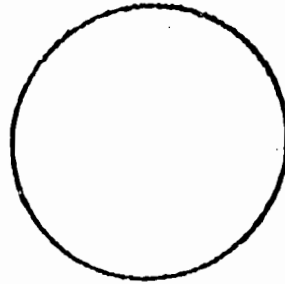
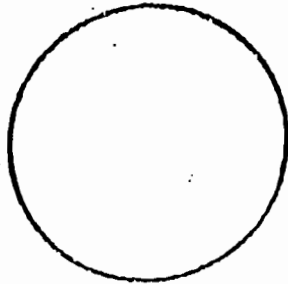
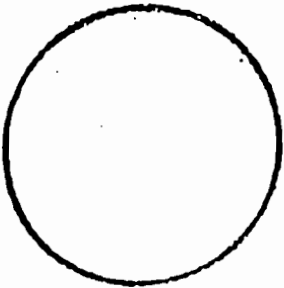
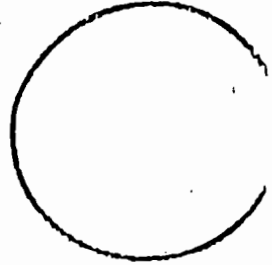
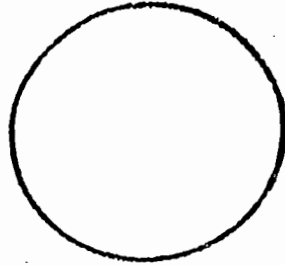
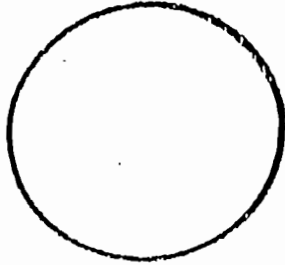
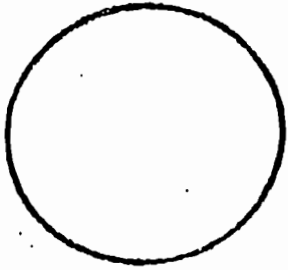
60. In the diagram above, the translation vector that maps triangle PQR onto triangle LMN is

- (A) $\begin{pmatrix} -8 \\ -3 \end{pmatrix}$
- (B) $\begin{pmatrix} 2 \\ 1 \end{pmatrix}$
- (C) $\begin{pmatrix} 6 \\ 2 \end{pmatrix}$
- (D) $\begin{pmatrix} 8 \\ 3 \end{pmatrix}$

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

CIRCLES TEST

See how many objects you can make from the circles below by adding lines inside or outside or both inside and outside. Try to think of as many different things as you can which no one else will think of. Put as many ideas as you can into each. If your idea is not very clear you may put a title underneath the circle.



FOLLOW-UP EXERCISE ON CREATIVITY

There is a list of 45 words below. Beside each, you are to write as many related words as you can think of. Two examples are given to guide you.

Example 1: Word given: PIN Related words: HAIR, CLOTHES, COMMON

Example 2: Word given: SIDE Related words: SEA, BURN, WALK

Write as many related words as you can think of for each.

1. CIVIL

2. HOUSE

3. PARTY

4. PICK

5. MILL

6. DALL

7. FINE

8. WAVE

9. SHELL

10. LIGHT

11. ICE

12. HORN

13. LINE

14. POX

15. CHASE

16. STRING

17. STOP

18. HUB

19. LOCK

20. HORSE

21. COAT

22. WEATHER

23. HIND

24. NONE

25. MASTER

26. LAMP

27. DRUM

28. HOUSE

APPENDIX 8**The Ennis-Weir Critical Thinking Essay Test****DIRECTIONS**

Read the letter to the editor of the Moorburg newspaper. Consider it paragraph by paragraph and as a total argument. Then write a letter to the editor in response to this one. For each paragraph in the letter you are about to read, write a paragraph in reply telling whether you believe the thinking good or bad. Also write a paragraph about the total argument. Defend your judgments with reasons.

Your answer should have nine numbered paragraphs. Numbers 1 through 8 should give your reactions to paragraphs 1 through 8 in the letter. Your paragraph number 9 should give your overall evaluation of the letter considered as one total argument. Each paragraph, including the last, should contain your reason(s).

Spend about ten minutes reading the letter and thinking about it. Then write for not more than thirty minutes (about three minutes for each of your short paragraphs). The maximum total time is forty minutes.

Do not forget to give your reasons in each paragraph. Please write clearly.

Remember, write nine numbered paragraphs, and give reasons.

APPENDIX 8 (contd.)

THE MOORBURG LETTER

230 Sycamore Street,
Moorburg,
April 10

Dear Editor:

Overnight parking on all streets in Moorburg should be eliminated. To achieve this goal, parking should be prohibited from 2 a.m. to 6 a.m. There are a number of reasons why any intelligent citizen should agree.

1. For one thing, to park overnight is to have a garage in the streets. Now it is illegal for anyone to have a garage in the city streets. Clearly then it should be against the law to park overnight in the streets.

2. Three important streets, Lincoln Avenue, Marquand Avenue and west main street are very narrow. With cars parked on the streets, there isn't room for the heavy traffic that passes over them in the afternoon rush hour. When driving home in the afternoon after work, it takes me thirty-five minutes to make a trip that takes ten minutes during the uncrowded time. If there were no cars parked on the side of these streets, they could handle considerably more traffic.

3. Traffic on some streets is also bad in the morning when factory workers are on their way to the 6 a.m. shift. If there were no cars parked on these streets between 2 a.m. and 6 a.m., then there would be more room for this traffic.

4. Furthermore there can be no doubt that, in general, overnight parking on the streets is undesirable. It is definitely bad and should be opposed.

5. If parking is prohibited from 2 a.m. to 6 a.m., the accidents between parked and moving vehicles will be nearly eliminated during this period. All intelligent citizens would regard the near elimination of accidents in any period as highly desirable. So we should be in favour of prohibiting parking from 2 a.m. to 6 a.m.

APPENDIX 9

ANSWER KEY - ENGLISH LANGUAGE

1.	B	31.	C
2.	A	32.	D
3.	A	33.	B
4.	D	34.	A
5.	C	35.	B
6.	B	36.	C
7.	A	37.	A
8.	B	38.	B
9.	D	39.	A
10.	C	40.	C
11.	B	41.	A
12.	D	42.	C
13.	B	43.	D
14.	A	44.	D
15.	D	45.	C
16.	A	46.	A
17.	B	47.	D
18.	C	48.	A
19.	B	49.	B
20.	D	50.	C
21.	C	51.	B
22.	C	52.	C
23.	A	53.	D
24.	D	54.	C
25.	A	55.	B
26.	A	56.	B
27.	A	57.	D
28.	C	58.	C
29.	A	59.	A
30.	D	60.	D

APPENDIX 10

ANSWER KEY - MATHEMATICS

- | | | | |
|-----|---|-----|---|
| 1. | D | 31. | B |
| 2. | C | 32. | B |
| 3. | A | 33. | C |
| 4. | C | 34. | C |
| 5. | C | 35. | D |
| 6. | D | 36. | A |
| 7. | B | 37. | B |
| 8. | A | 38. | D |
| 9. | A | 39. | A |
| 10. | B | 40. | C |
| 11. | A | 41. | D |
| 12. | C | 42. | B |
| 13. | C | 43. | C |
| 14. | C | 44. | A |
| 15. | C | 45. | A |
| 16. | H | 46. | A |
| 17. | B | 47. | D |
| 18. | C | 48. | C |
| 19. | C | 49. | A |
| 20. | B | 50. | A |
| 21. | B | 51. | D |
| 22. | C | 52. | C |
| 23. | B | 53. | C |
| 24. | D | 54. | A |
| 25. | B | 55. | A |
| 26. | C | 56. | D |
| 27. | C | 57. | A |
| 28. | C | 58. | C |
| 29. | D | 59. | C |
| 30. | B | 60. | D |

APPENDIX 11

SCORING PROCEDURE - CIRCLES TEST

<u>0</u>	<u>1</u>	<u>2</u>
Face	Coin	Drum
Ball	Eye	Brush
Clock	Fan	Yo Yo
Sun	Cookie	Binoculars
Moon	Logo	Guitar
Star	Target	Satellite Receiver
Globe/Earth	Cone	Snail
Tyre/Wheel	Spectacles	Windmill
Cat	Lollipop	Spider's Web
Fruit	Bulb	Ying/Yang
Geometric Designs	Watch	Butterfly
Sign	Pie-Chart	Telescope
Flower	Buttons	Kite
Pot	Ring	Telephone
Pan	Cake	Switch
Can	Record	Compass
Bin	Funnel	
	Donut	
	Bicycle	
	Plate	

APPENDIX 12

CRITERIA AND SCORING SHEET
ENNIS-WEIR CRITICAL THINKING TEST

(Maximum credit for each paragraph is 3 points except for #9)

1. Recognition of misuses of analogy, and/or recognition of shift of meaning and/or claim that ~~incorrect~~ definition has been stipulated.
2. ~~Recognition of irrelevance.~~
3. Recognition that #3 is OK. (Neglecting the busy streets limitation is not penalized).
4. Recognition of circularity, and/or recognition that no reason is offered.
5. Recognition that there may be other ways of preventing accidents, and/or recognition that other things might be more desirable, and/or recognition that there probably isn't much traffic at that time, and/or recognition that other types of accidents are unaffected, and/or recognition that no evidence has been given that such accidents occur. (Other ~~possibilities~~).
6. Recognition of lack of controls, and/or "only one case", and/or "post hoc fallacy". (Other possible explanations).
7. Recognition of winning argument by definition, and/or recognition that a word has been made useless for empirical assertion, and/or claim that an incorrect definition has been asserted.
8. Recognition that #8 is OK.
9. One point for just condemning the overall argument; another point for reviewing or summarising the responses to the other paragraphs in some reasonable way; two points for recognising (anywhere) the error of concluding about all streets on the basis of reasons only about busy streets; and one point for noting (anywhere) that Raywift has attempted to push people around with his emotive language.

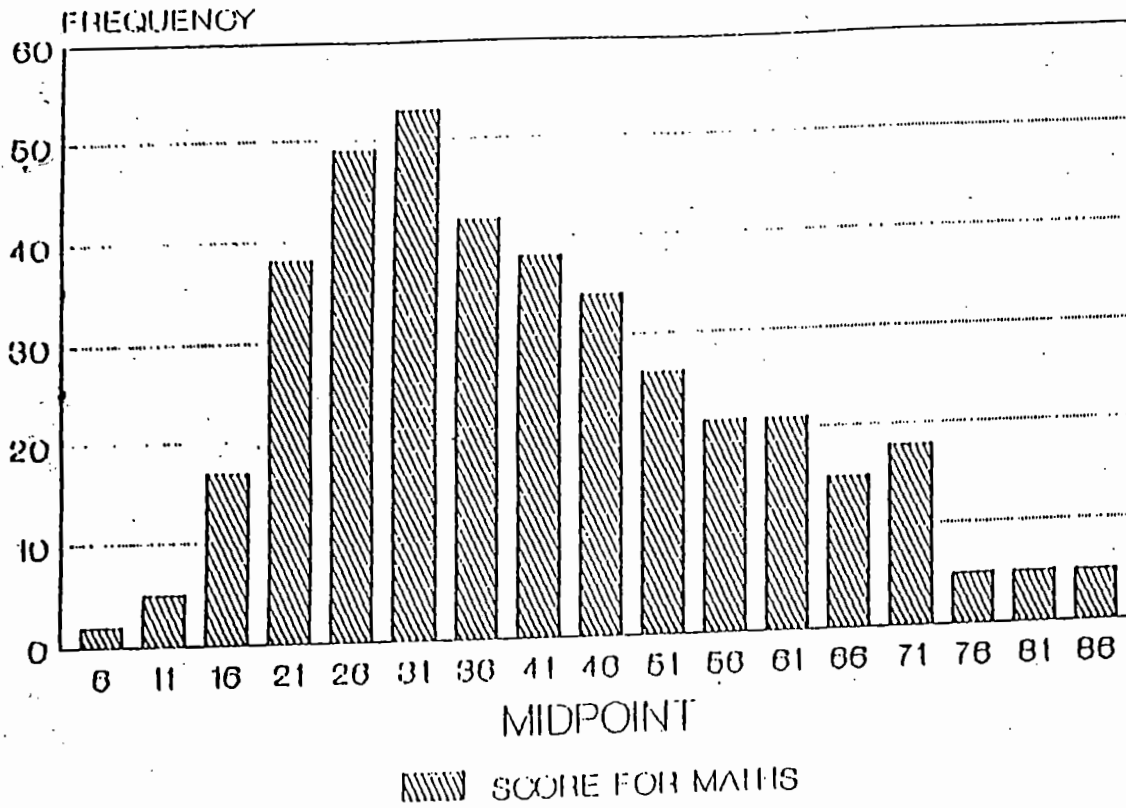
Total possible: 29 points.

PLACES CLASSIFIED AS URBAN (1982 CENSUS)

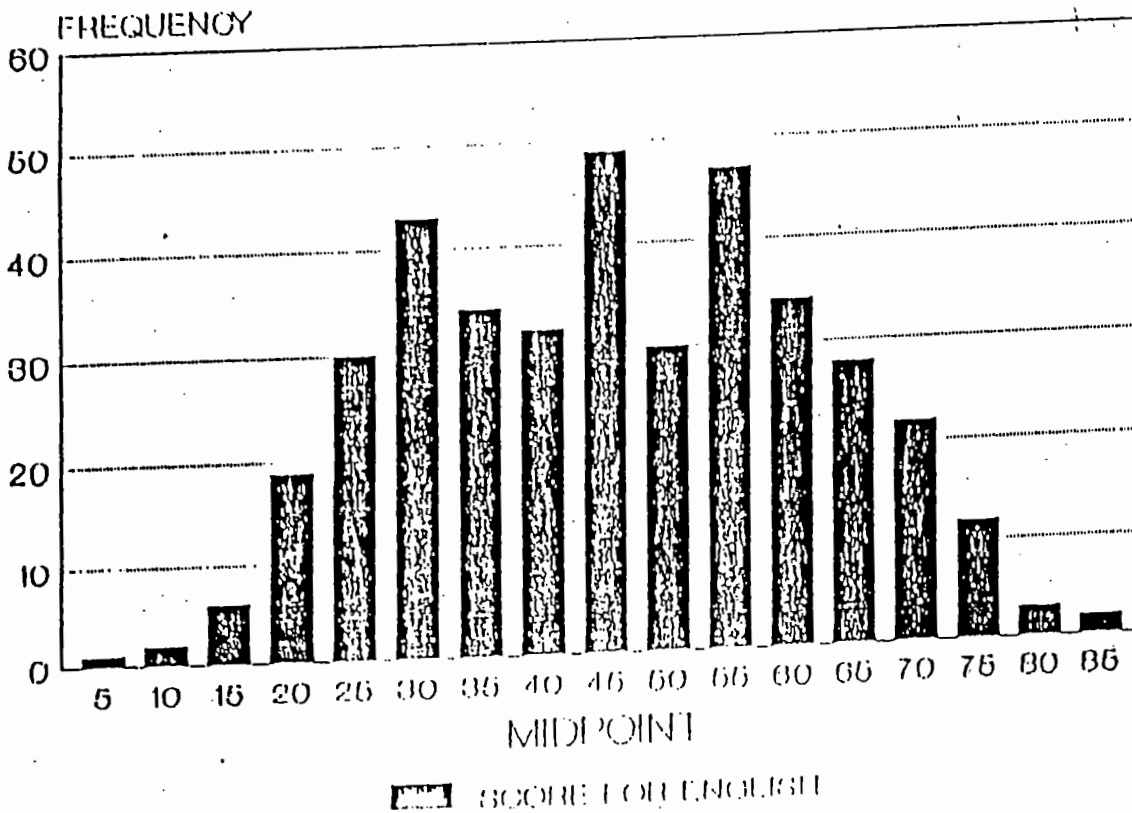
<u>PARISH</u>	<u>AREAS DESIGNATED</u>
Kingston Metropolitan Area	All of Kingston & much of St. Andrew
St. Thomas	Morant Bay, Yallahs, Bath, Port Morant.
St. Mary	Port Maria, Oracabessa Highgate, Annotto Bay.
Portland	Port Antonio, Buff Bay
St. Ann	St. Ann's Bay, Ocho Rios, Brown's Town, Runaway Bay
Trelawny	Falmouth, Clark's Town
St. James	Albert Town.
Westmoreland	Montego Bay
St. Elizabeth	Louisa Savanna-la-mar, Grange Hill
Manchester	Black River, Santa Cruz, Balaclava
Clarendon	Mandeville, Christiana Porus, Spaldings May Pen, Chapelton, Frankfield, Spaldings, Lionel Town
St. Catherine	Spanish Town, Linstead Old Harbour, Old Harbour Bay Bog Walk, Ewarton Portmore

APPENDIX 14

APPENDIX 14 FREQUENCY DISTRIBUTION OF MATHEMATICS SCORES.

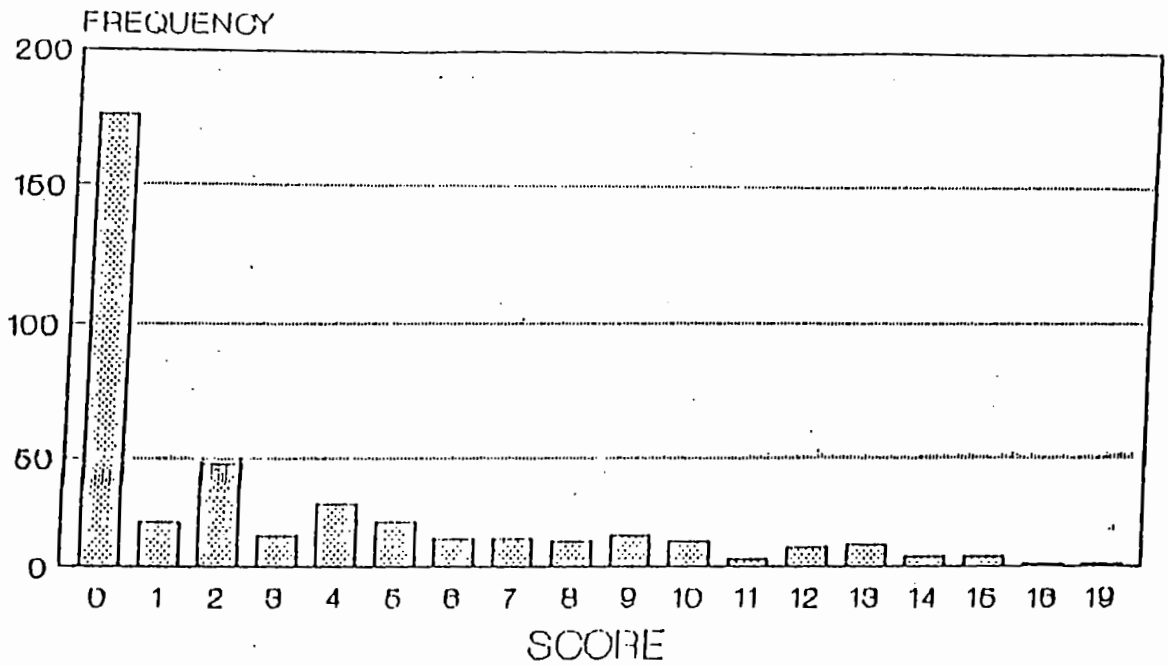


APPENDIX 14 FREQUENCY DISTRIBUTION OF ENGLISH SCORES.



APPENDIX 15

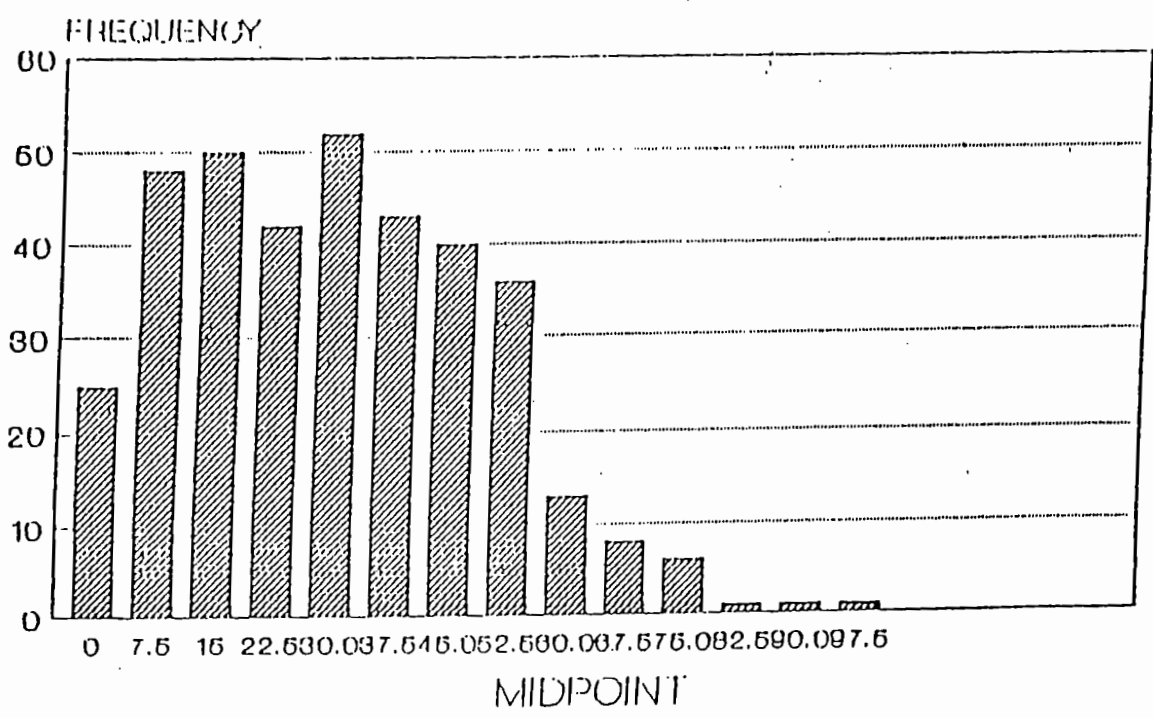
APPENDIX 16 FREQUENCY DISTRIBUTION OF CREATIVITY 1 SCORES*



CREATIVITY 1 SCORE

(N - 307)
* REFERS TO SCORE ON CIRCLES TEST

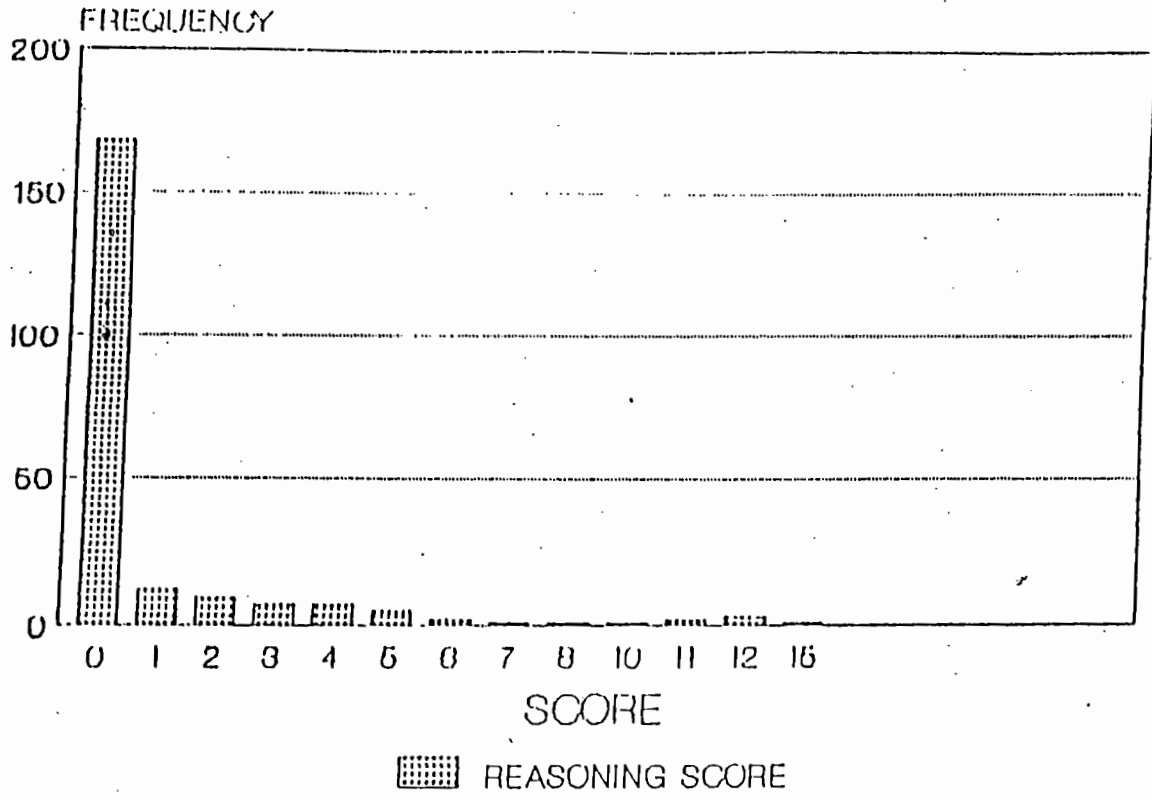
APPENDIX 15 FREQUENCY DISTRIBUTION OF CREATIVITY 2 SCORES*



CREATIVITY 2 SCORE

(N - 100)
* REFERS TO SCORE ON WORD ASSOC. TEST

APPENDIX 19 FREQUENCY DISTRIBUTION
OF REASONING SCORES



(N - 219)