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Curriculum needs of entry-level agribusiness managers in Jamaica

McKenzie, James Durwin, Ph.D.

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U·M·I
300 N. Zeeb Rd.
Ann Arbor, MI 48106

CURRICULUM NEEDS OF ENTRY-LEVEL AGRIBUSINESS MANAGERS IN JAMAICA

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James D. McKenzie
B.S., University of the West Indies, 1974
M.A., Michigan State University, 1980
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ABSTRACT

For developing countries, establishing linkages between education and key productive sectors of their economies is a top priority in their agendas for higher education. This interaction is essential to ensure that job requirements are matched by the qualification of job recruits. This study used the framework of job analysis to identify the importance of job skills and personal qualities required by entry-level agribusiness managers and to determine if the curriculum of the College of Agriculture, Jamaica, was providing these skills and qualities. The Agribusiness Management Aptitude and Skill Survey (AGRI-MASS) was used to survey top and middle management personnel in four types and three sizes of agribusiness firms in Jamaica.

The order of importance of six AGRI-MASS skill areas were communication; personal qualities; business and economics; technical; employment, work and general experiences; and computer, quantitative and management information. Significant differences in the importance of 22 skills were identified among firms of different types and in 23 skills among firms of different sizes. The most diverse requirements were identified for business and economic skills among the different types and sizes of firms and business and economic skills and technical skills among firms of different sizes. A score of 4.0, established as the minimum criterion for a skill to be included in the curriculum, was met by 66 (89%) of 74 specific AGRI-MASS skills. Most skills in the area of computer, quantitative and management information did not meet the criterion.

The curriculum of the College of Agriculture provided training covering 33 AGRI-MASS skills. The area least covered was that of personal qualities and constituted the most urgent curriculum need. Technical skills was the area most comprehensively covered.

The study initiates meaningful collaboration between the agricultural industry and higher education in Jamaica and suggests approaches for curriculum improvement and additional research.

CHAPTER I

INTRODUCTION

Background

Over the past thirty years Jamaica has witnessed a six-fold growth in its urban population. At the same time, the expansion of farm production has shifted to export-oriented commercial operations. Output from subsistence farming, on the other hand, has suffered a vast per capita decline (Miller & Murray, 1977; LSUAC & LSU, 1985). These changes have resulted in high importation of agricultural inputs and raw materials. At the same time, to meet the food requirements of the increasing urban population and input services to commercial farms, agribusiness firms have emerged as a significant sector of the Jamaican economy. As Ayub (1981) has pointed out, the initial impetus for general industrial development in Jamaica was the demand for products of agribusiness; specifically, the demand of the sugar and other food sub-sectors.

Most of these changes are consistent with Davis and Goldberg's suggestion that the agribusiness economy in the United States came about by the gradual dispersion of functions from agriculture to business. In addition to the commercial business units concerned with handling, storing, processing, and distributing agricultural commodities, Davis and Goldberg include in the agribusiness economy, commodity organizations, farm organizations, and research units. They proposed also that government's engagement in research, regulation,

ownership and trading of farm commodities made it a part of agribusiness (Davis & Goldberg, 1957).

Despite the emergence of agribusiness in Jamaica's economy, curricula and training in agricultural institutions have been almost entirely farm-oriented. This partly reflects the manpower development aspect of government's agricultural policy. Extension education aimed at small farmers and farm families is the principal focus of this policy (LSUAC & LSU, 1985). In addition, vocational education in secondary schools is devoted entirely to on-farm activities.

The sharp focus on small farmers has strong historical roots. Table 1 shows the distribution of agricultural property over a twenty-five year period.

Table 1

Distribution of Agricultural Land in Jamaica

	Size of Farms (acres)	No. of Farms (percent)	Acreage (percent)
1954	< 5	69.91	13.01
	5 - 25	26.66	26.27
	> 25	3.43	60.72
1958	< 5	70.79	14.86
	5 - 25	26.72	29.97
	> 25	2.49	55.17
1969	< 2	78.55	14.85
	5 - 25	19.35	22.13
	> 25	2.10	63.12
1978	< 5	81.87	16.01
	5 - 25	16.22	19.28
	> 25	1.90	64.70

Small farmer employment now accounts for 30% of the total labor force of the country, and 40 percent of the land under production (LSUAC & LSU, 1985; Boyd, 1988). Larger farms of 100 acres and over devote 80 percent of their acreage to producing export crops, livestock, and poultry, rather than domestic crops on which small farmers concentrate (Boyd, 1988). It is these commodities produced by the larger farms and firms established to handle them and to provide the required services, which are the basis of the agribusiness sector.

The small farm sector itself depends in large measure upon the agribusiness sector for most of its diverse food needs as well as its production inputs.

Chandler (1989) noted a similar imbalance in this aspect of Australian agriculture and observed that it was unique for any major industry. Davis and Goldberg (1957) identified a comparable phenomenon in the early stages of agribusiness development in the United States. They remarked that slowness to recognize the changing conditions, and absence of a comprehensive well-balanced agribusiness policy resulting therefrom, was the factor most responsible for limiting balanced progress and economic growth in the food and fibre economy at that time.

Educational System

Before the impact of commercialization, Jamaica was dominated by the village community. Subsistence agrarian activity was the predominant feature of the economy. The primary function of education in crafts and occupations, where

it existed, was to support primary food production. Formal education was focused almost entirely on universal primary education. The pattern for modernization of the educational system was set by the establishment of high schools by the church. Initially, this pattern of modernization was not related to such social roles as employment, however.

In the system existing today, primary education is offered from grades 1 to 6 of public and private schools. In 1988 - 89 all children in the 6 to 11 age group were enrolled. The attendance rate during the period was 75%. Secondary education consists of two cycles: grades 7 to 9 in all-age schools, new secondary, comprehensive high, secondary high, technical high, and independent high schools; grades 10 and 11 of the schools named above (with the exception of all-age schools) as well as agricultural and vocational schools. Some secondary schools continue to sixth form (grades 12 and 13).

Tertiary education is the term applied to post-secondary education, including higher education. Less that 3% of total educational enrollment is in tertiary education (Planning Institute of Jamaica, 1990).

Agricultural education

The earliest formal initiative in agricultural education was the Government Farm School established in 1910. In 1948 Knockalva Practical Training Center was founded to provide training in agriculture. With the establishment of Elim Agricultural School in 1978, Knockalva was renamed Knockalva Agricultural School. Today, both schools provide agricultural education at the secondary level

and are important sources of students entering the College of Agriculture. The present College of Agriculture can be traced to the Government Farm School through an interesting process of evolution. The original institution provided training mainly through on-farm apprenticeship and practical work. However, by 1957, the agricultural education goals of the country had changed. A substantial change in program emphasis ensued, accompanied by a change of name from Government Farm School to the Jamaica School of Agriculture (JSA).

The College of Agriculture (COA) is the successor institution to the Jamaica School of Agriculture. This change came about in 1982 on the initiative of the Minister of Education. She did so out of the perception that the JSA was, at that time, not adequately responsive to the changing educational needs of the agricultural industry. The principal emphasis of her proposal for improvement was a call for curriculum renewal (Mavis Gilmour, unpublished speech, 1980).

An interesting observation in the foregoing account is the association of each major change in higher agricultural education with a perceived failure of the existing institution to respond to the changing needs of the industry. Each time this change occurred, there was a high monetary cost of relocation and equally high transaction cost (Easter, Bisaliah & Dunbar, 1989)

The College of Agriculture is now the main institution providing higher education in agriculture. It offers a three-year Associate Degree in Science, completed over a three-year period of full-time residential study at its campus in Port Antonio. Each academic year consists of two semesters, sixteen weeks in

length, and a summer session of eight weeks. Formal academic courses are codified into credit units, one credit unit being equivalent to one hour of lecture or two hours of laboratory work per week per semester. To earn the Associate Degree in Science, students are required to complete 123 credit units of classroom courses, a minimum of 1400 hours of farm practicals, and 320 hours of off-campus cooperative work experience.

The University of the West Indies is a regional institution funded by the Governments of West Indian countries. Its main campus is located in Jamaica at Mona and its agricultural campus is in Trinidad. Its programs include the bachelors, masters and doctoral degrees in various agricultural and related disciplines. In addition, a high proportion of students pursuing an agricultural degree do so in universities and colleges abroad, principally in the United States.

Agribusiness and education

Over a twenty-year period, 1970-1990, the contribution of the agricultural sector to Jamaica's economy has stagnated at 8.3 to 10 per cent of GDP (LSUAC & LSU, 1985). During that same period, two significant internationally funded development projects have focused on strengthening agricultural education to support national agricultural development. The first of these projects established two agricultural secondary schools for meeting the need for skilled technicians to serve agriculture (Miller & Murray, 1977). The second project was established with the purpose of overcoming one of the bottlenecks to agricultural development in Jamaica, namely inability to provide sufficient numbers of trained,

qualified personnel. Its main focus was further development of the College of Agriculture (LSUAC & LSU, 1985).

One of the five components of the latter project was to establish, within the College of Agriculture, a curriculum development center with the goals of:

(a) developing and revising agricultural curricula at various levels of the educational system;

(b) conducting curriculum research and development, and ensuring an appropriate balance between theory and practice in agricultural education.

Educational goals

In one of Jamaica's early national initiatives on education, Miller and Murray (1977) proposed that any assessment of current conditions of the educational system's objectives, priorities and methods of reform had to be predicated on a system of values and goals reflective of the wishes and objectives of society. They recommended a continuous or living approach as a means of regularly updating and restating goals and objectives for the country's development.

Set out in that document are the broad national goals of education in Jamaica. They include:

(a) the right of individuals to develop their potential through education, and with this right the opportunity to become self-sufficient, well-integrated, useful and responsible citizens, and

(b) a primary concern of government to provide training in skills to meet the growing agricultural, commercial, industrial, management, and cultural needs of the country.

As early as 1973, in a review of education in support of agriculture, it was stated that the educational system was entrusted with the task of awakening and guiding the interest of its students toward an agricultural career and developing their general and specific agricultural skills. The interdependence between the educational and the agricultural systems was emphasized, as well as the interdependence among schools, farms and agribusinesses. It was indicated that family and agribusiness interests depended on local institutions of higher agricultural education for most of their future qualified staff (Miller and Murray, 1977).

Statement of the Problem

Over the past 20 years a number of initiatives have been taken by the Government of Jamaica to address the educational needs of the agricultural sector (Miller & Murray, 1977; LSUAC & LSU, 1985). A large number of students, responding to these initiatives, have enrolled in tertiary and vocational agricultural education in pursuit of careers in agriculture. For students graduating from the College of Agriculture, and the agricultural secondary schools at Elim and Knockalva, one of the most popular career opportunities has been entry-level managerial and skilled technical positions in agribusinesses (Thomas, personal communication, March 1992). These students would be better prepared in

making educational choices and selecting opportunities leading to successful careers if they were aware of the knowledge, skills and aptitudes required of them. It is a prime responsibility of leaders of educational institutions to know the content areas that future agribusiness employees should be studying, the skills they should be developing, and any curriculum innovations which would help meet the developmental needs of students for gainful employment.

Purpose and Objectives

The purpose of this study was to determine the extent to which the curriculum offered by the College of Agriculture meets the training needs of entry-level agribusiness managers and to identify the tasks performed in entry-level managerial positions in agribusiness firms in Jamaica.

The specific objectives of the study were:

1. to identify the entry-level skills perceived by agribusiness employers to be important for entry-level managers;
2. to determine the differences in perceived importance of skills by type and size of agribusiness firms;
3. to determine the relevance of the curriculum of the College of Agriculture in preparing graduates for entry-level managerial tasks in agribusiness firms.

Significance of the Study

Colleges of Agriculture have been a major source of graduates planning to enter agribusiness careers. From time to time questions arise regarding the

quality and readiness of graduates for future agribusiness employment. The evolution and spread of agribusiness in Jamaica have generated interest and aroused similar questions with respect to students being prepared for the local agribusiness economy. By directing this study toward finding out how various knowledge, skills and aptitudes are valued by the agribusiness market place, the researcher hoped to provide information which will contribute to the strength and relevance of the curriculum of the nation's College of Agriculture and agricultural high schools; enhance the career potential of graduates and their competitiveness; and enhance recruitment by agribusiness employers.

Furthermore, as an initial study about the educational needs of the local agribusiness economy, it will serve as a basis of baseline knowledge. In particular, for Jamaica, a developing economy, subsequent replicative studies hold the interesting potential of revealing changes in the relative importance of knowledge, skills and aptitudes demanded by agribusinesses over time.

Limitations of the Study

1. Curriculum decisions are based on information derived from learners (students), discipline experts, and contemporary society. Since the study focuses on employers, one segment of contemporary society, conclusions and recommendations for curriculum changes have to be considered in the total context.

2. In comparing AGRI-MASS skills perceived to be important for entry-level managers with course concepts in the College of Agriculture curriculum, the

researcher assumes that breadth and depth of instruction received in the several concepts are appropriate to the skill level of AGRI-MASS.

CHAPTER II

REVIEW OF LITERATURE

Attempts to establish linkages between education and national development goals, and thereby find ways of training the work force have emerged as a high priority for higher education in developing countries. Fraisier (1988) made the point that how well these linkages are developed between public education and the private sector will vary by business, within communities and across the nation. Sanyal, et al. (1983) perceived such linkages as a measure of mutuality between higher education and social and economic change. They observed, however, that in many instances the expansion of higher education created as many problems as it solved. Among them were problems caused by a lack of relevance of the content and structure of higher education with respect to national needs, since in most countries expansion in higher education often does not give consideration to changes in social and economic needs. They cited the additional problem of a lack of confidence by key production sectors of the economy in the institutions of higher education, due to the absence of interaction between these industries and the institutions. Quantitative and qualitative mismatch between output of students and their employability is one of the most important problems thus created. Another problem is that administrators of higher education have been handicapped by the ever-changing nature of the employment market. The principal difficulties are a lack of information on the educational needs of different kinds of jobs and the attitudes and expectations of

potential employees and employers. These difficulties can be tackled only by making the system of higher education more flexible to cope with changing economic realities (Sanyal, et al., 1987).

The conditions of work, and recruitment and promotion policies of employers influence the type of qualification that an employee should have. Therefore, the development of human resources depends on the operation of the labor market and the prevailing employment policy. The policy of human resource development for economic and social needs calls for an analysis of the skills needed for the various activities of the economy. The output of the educational system by type of skills taught has to be known for proper utilization of the human resources it generates.

In this regard, the problem of estimating the future needs for highly qualified manpower and an analysis of the match between the quality of the training content demanded by the economy and the responsiveness of the institutions of higher education is particularly useful. This analysis of matching has the potential to bring out the shortcomings of the educational system and provide useful information for decision-making to improve the relationship between higher education and the world of work. A better match between the expectations and qualifications of graduates and the expectations and requirements of employers could result in higher productivity, and adoption of better employment procedures and selection criteria (Smith, 1986)

The Concept of Job Analysis

McCormick (1979) makes the point that the fitness of candidates for any given job is predicated on two types of data: the first dealing with the requirements of the job itself, and the second dealing with the qualifications of the candidate. The objective of selection is to match the qualifications of the candidate with the requirements of the job. However, McCormick maintains that the requirements for some jobs probably have been based on little more than guesses or unsupported judgements. Instead, good professional practice should be guided by sound, job-related data, as that is the most justifiable basis for establishing statements of job requirements (McCormick, 1979).

Job analysis is the procedure used for identifying different kinds of performance made possible through learning. It should be the initial step for sequencing structural units in the design of training or instruction (Kennedy, Esque & Novak, 1984). Its purpose is to describe a job in terms of its component tasks to permit optimal learning design and reduction of performance error (Carlisle, 1984). A second view of its purpose is that it provides information about instructional content. Such information may be used for describing instructional strategies, including the selection of enabling skills and knowledge (Reigeluth, 1984).

The educator's concern with job analysis is connected to the search for a bridge among theory, practice, and need. In this pursuit, few people publicly question the importance of task analysis (Davies, 1973). Some persons have

argued that task analysis is likely to be one of the lasting overall contributions of programmed instruction to educational technology (Duncan, 1972). Davies argued that the real importance of task analysis is its formal or theoretical justification. Without such a justification, task analysis is essentially no more than a series of arbitrary techniques or procedures imposed upon an instructional development framework (Davies, 1973). Its theoretical justification finds support in its contribution to the description and prediction of human performance achievement (Prien & Ronan, 1971). By this means, task analysis serves as a practical means of interfacing a theory of knowledge with a theory of instruction, and a theory of learning (Davies, 1973).

In terms of this interface, three functions are performed by job analysis (Davies, 1973). First, by its concern with prescribing prerequisites and conditions under which performance may be optimally developed (Gagne, 1985; Gagne & Briggs, 1979; Tyler, 1961), job analysis serves a theory of instruction (Davies, 1973).

The second function performed by job analysis serves a theory of learning in terms of describing the behaviors and processes through which performance may be optimally obtained. Thirdly, by providing a means through which basic questions concerning the relevance and utility of performance may be explored, task analysis serves a theory of knowledge. Information about pre-requisites and conditions, behaviors and processes, and relevance and utility must be reflected in job analysis, otherwise it is unlikely that the right decisions and priorities will be

determined and balanced (Davies, 1973). It is through these three roles that task analysis serves as a bridge among theories of knowledge, instruction, and learning (Prien and Ronan, 1971).

Sound, job-related data obtained through a process of job analysis is the most justifiable basis for establishing statements of job requirements. In the process the important work aspects of jobs should be identified in such a manner that inferences can be made about their job requirements (McCormick, 1979). Sims, Veres, & Heninger (1989) suggested that job analysis which defines the skills, knowledge, and abilities required by various positions within an organization, would provide the information needed to accurately assess employee educational needs and the organization's human resource needs. They suggested, in addition, that such assessments help in the design of an effective, viable training program.

Fleishman proposed that an important use of job analysis is to permit the classification of job tasks with respect to training methods found most effective in promoting high levels of task performance. Fleishman remarked further that in a review of job analysis research, he found that a number of investigators have called for the establishment of task categories that are relatively homogeneous with respect to principles of learning and training techniques. He insisted that such a purpose was perhaps served by Bloom's educational taxonomy. Fleishman (1967, 1974) himself designed research specifically to yield a behavioral taxonomy for describing jobs. His intent was to describe psychomotor work in terms of

human capability. He studied performance on more than 200 tasks and identified ten psychomotor factors and nine physical proficiency factors.

A similar concern is evident in Gagne's attempt to specify the relationship between tasks as learning categories and the principles of learning (Gagne, 1985). He proposed that conditions are not the same for different varieties of what is learned. On this basis, he identified five categories of human performance which may be established by learning. They are intellectual skills; verbal information; cognitive strategies; motor skills; and attitudes. He suggested that they were learned capabilities, which differed not only in the performance they make possible, but also in the conditions most favorable for their learning (Gagne, 1985).

Issues in Terminology

Mabon (1974) and McCormick (1979) have suggested that the terminology in the job analysis literature is by no means uniform. For instance, careful distinctions were seldom made among analyses, description, specifications, and evaluations, or between descriptions which were job-oriented and those which were worker-oriented. The conceptual confusion, they believed, arose partly because different researchers and practitioners had greatly varying approaches and purposes when dealing with the problem of job analysis.

According to Melching and Borcher (1973), a widely used concept of work makes a distinction among three levels: position, job and occupation. By that formulation:

A position consists of a collection of duties which are performed by a single individual: for example, the position of marketing manager of a business firm. There are as many positions as there are full-time employees in a company. A position exists, whether occupied or vacant.

A job consists of a group of closely related positions where the duties are more or less the same for different incumbents. The major or significant tasks in a job are sufficiently alike to be covered in the same analysis. There may be one or many persons in a job. Typists or manual lathe operators are examples.

An occupation refers to the jobs of a general class without regard to organizational lines. Thus, one refers to the occupation of accountant wherever people engage in that activity.

A task is considered to be a distinct unit of work performed by an individual. It usually comprises a logical and necessary step in the performance of a duty, and typically has an identifiable beginning and an ending. Melching and Borcher (1973) give examples of tasks: solder minor leaks in radiator; type minutes of reports of meetings; replace brake and hose lines. A task statement typically consists of two basic elements: a specific action verb, and a brief indication of what is acted upon, such as compute product moment correlation on a desk calculator. In a mental task it is more difficult to identify the beginning and ending of the activity. In these instances, it is also difficult to identify the nature of whatever mental activity has actually taken place without an overt indication by the individual in question.

Educational Implications

Educational programs are designed or selected with certain broad goals in mind. Gagne (1974) affirmed that their analysis was always necessary in order to address the issue of what was required of human learning in attaining these goals. The purpose of job analysis is to make possible the detailed specifications of what must be learned, that is, the human tasks the learner will be able to accomplish when the period of training has been completed. In using job analysis to design educational programs, the identification of human actions, their dependencies, and their sequence is a desirable, and often, an essential first step in the specification of the required outcomes of learning (Gagne, 1974).

Gagne & Briggs (1979) assert that the best way to design instruction is to work backwards from its expected outcome, the human capabilities to be established by instruction. The society in which one lives has certain functions to perform in serving the needs of its people. It is these functions which require human activities which must be learned. Accordingly, it is the function of the society that such learning takes place (Gagne & Briggs, 1979). Gagne (1985) also maintains that the proper application of principles of learning to achieve effective outcomes requires that the class of learning outcomes be identified for any specific learning task that the learner undertakes. Evidently, then, when an instructional plan for learning is to be made, an initial step is to conduct an analysis of the particular outcome to be expected.

In the present study, the focus of job analysis is on curriculum. To design effective instruction, educators must first be aware of the curriculum that needs to be provided. If what is taught in job-related training is outmoded or irrelevant to the target population, the student will lack preparation for its entry-level positions. Flanagan (1973) underscores this point in his proposition that the quality of educational programs could be improved by systematic selection of what is to be taught. A principal role of job analysis is to uncover and describe that set of substantial and stable behaviors, identified by Lessinger (1965), around which educational programs must be built.

Methodological Approaches to Job Analysis

A review of literature by Prien and Ronan (1971) identified a variety of methods used in job analysis. They concluded that all these methods had one underlying theme, that of dissecting human work into tasks. The dominant objectives of such a dissection are training and system development (McCormick, 1975). McCormick (1979) identified four dimensions on which analysis could vary: (1) the types of descriptors or elements used to describe jobs, (2) the forms in which job information is obtained or presented, (3) the sources of job information, and (4) the methods of data collection. The types of job descriptors can vary in their levels of specificity.

Job descriptors

Perhaps the most common distinction with respect to descriptors is made between task-oriented and worker-oriented approaches (Ash, 1988). Task-

oriented approaches focus on tasks and behaviors needed to produce an output or service. This approach to task analysis typically excludes the human element and the facet of interpersonal interaction other than to the extent involved directly in the task element (Prien & Ronan, 1971).

Forms of information

Form of information usually refers to the distinction between qualitative and quantitative description of job information. Quantitative information characterizes jobs in numeric terms or units. Qualitative information, on the other hand, refers to verbal, narrative description of job information. Ash (1988) suggested that most job analysis methods developed since 1970 typically use both forms of job analysis information.

Sources of job information

Among the agents or sources of information, Mabon (1974) and Ash (1988) list the job holders or incumbents, first-level supervisors, higher-level supervisors, job analysts, technical experts, written records and training manuals.

Data collection methods

Three general methods of data collection are indicated in the literature, namely observation, interviews and questionnaires (Ash,1988; McCormick, 1975, 1979; Melching & Borcher, 1973). Martinko (1988) discusses two varieties of observational analyses: direct observation, and work sampling. Information is gathered through intensive direct study of incumbents by trained job analysts, and involves collection of information on sequences of observed behavior. Ash (1988)

suggested that this approach was largely used in respect of jobs that consist of repeated manual operations over a short cycle. He also suggested that film or video recordings of job activities, subsequently studied by job analysts, may be a suitable substitute for observation in some contexts.

The individual interview approach typically involves one or more job analysts asking incumbents, supervisors, and occasionally subordinates, similar questions about the job under analysis. Group interviews are similar to individual interviews, except that multiple respondents are interviewed at the same time. The present study will use the individual interview approach.

Technical conferences, also called supervisory or subject matter expert conferences, are used to collect information when job holders either are not desired to be included or are unable to participate in job analysis. In a technical conference, the job analyst guides a discussion of technical experts and/or supervisors identifying job tasks and behaviors or inferring desired or required personal characteristics of job incumbents (Ash, 1988).

DACUM (Developing a Curriculum) employs this approach. Adams (1975) defines it as a single sheet skill profile that serves as both a curriculum plan and an evaluation instrument for occupational training programs. The method relies on experts employed in the occupational area to determine the curriculum content and allows them to be guided through a systematic content determination process (Finch & Crunkilton, 1993).

Structured questionnaires and checklists typically contain the characteristics likely to be encountered in the job under analysis and require the respondents to indicate to what extent they perform the list of tasks or behaviors, or use the listed knowledge, skills, or abilities. In contrast, unstructured questionnaires rely on respondents to provide most of the narrative description of the tasks performed in and personal characteristics required by the job under analysis.

Many contemporary job analyses combine several methods of collecting quantitative and qualitative data from multiple sources and use multiple data collection methods (Ash, 1988). The Vocational-Technical Education Consortium of States (V-TECS) uses a task inventory job analysis. The first step in using this method involves developing task statements for inclusion in a task inventory questionnaire (Christal & Weissmuller, 1988; Melching & Borcher, 1973; Finch & Crunkilton, 1989). To develop this inventory, job analysts are likely to use a combination of individual or group interviews, open-ended questionnaires, and observation, in addition to a review of existing literature (Ash, 1988). This approach provides the pattern for the present study. It relies upon individual interviews, open-ended questions, and a review of literature.

The job analysis literature proposes many uses for job analysis information. McCormick, Cunningham, and Gordon (1967) suggested that the purpose of job analysis was to identify optimal training methods for various jobs, while Gagne (1962) indicated that defining education and training objectives, and designing training and instructional methods were major purposes. Job analysis information

is also applicable in performance evaluation and determining compensation (PAQ Services, Inc., 1990)

Job Analysis Applications

One of the most extensive applications of job analysis for curriculum development is the work done by the Vocational Educational Consortium of States (V-TECS). V-TECS represents a cooperative effort among sixteen states and the U.S military services to develop catalogs of performance objectives, criterion-reference measures and guides in selected occupational areas. The consortium is administered by the Southern Association of Colleges and Schools. The V-TECS approach is that of task inventory, based in part on research conducted at the Lackland Air Force Base, Texas, by Morsh and Archer. This work resulted in the development of a procedure for conducting occupational surveys and enabled educators to study systematically the behavioral aspects of job requirements (Mitchell, Ruck, & Driskill, 1988). The approach used by the Center for Vocational and Technical Education at The Ohio State University is also an application of U.S. Air Force task inventory concepts (Melching and Borcher, 1973). V-TECS utilizes a five-step procedure in conducting job analysis, namely (1) reviewing relevant literature, (2) developing an inventory of job tasks, (3) selecting sample of subjects, (4) administering the inventory, and (5) analyzing the collected information (Finch and Crunkilton, 1989). The approach is widely applied to competency identification studies in vocational education. The goal is to identify and verify the tasks performed by workers employed in a particular job.

In the V-TECS scheme, a worker's job consists of duties and tasks which are actually performed. In this usage, duties are large segments of work done by an individual that typically serve as broad categories within which tasks may be placed. Tasks are, therefore, work activity units that form a significant aspect of a duty.

Blank (1982) suggested that the terms category and competency may be substituted for duty and task, respectively. He defined categories as major work segments in an occupation. Varying numbers of related competencies are included within each category. Under this usage, competencies indicate the knowledge, aptitudes, and characteristics which students must possess in order to meet on-the-job capabilities and behaviors. Roth and Tesolowski (1984) and Tesolowski and Roth (1988) applied this usage in a DACUM process to identify competencies that are needed by vocational educators to apply microcomputers in their programs. The same terms are applicable to job analysis done by Litzenberg and Schneider in developing AGRI-MASS (Agribusiness Management Aptitude and Skills Survey) to identify the knowledge, skills and characteristics needed by future managers in the agribusiness industry (Litzenberg and Schneider, 1987a). A similar usage will be employed in this study.

The type of descriptors is one of the four dimensions on which job analysis can vary (McCormick, 1975; Ash, 1988). The other three dimensions are the forms in which job information is obtained and/or presented; the sources of job information; and the method of data collection. Cornelius (1988) identifies nine

levels of specificity associated with the types of descriptors used in job analysis. They are tasks and activity performed; worker-oriented processes; abilities and aptitudes; working conditions and hazards; skills and knowledge; responsibilities; physical demands; education and training required; and motivating characteristics. The present study uses knowledge, skills and aptitudes as descriptors.

Consistent with the need to make a distinction between task and job, it is often necessary to do the same in respect of task analysis and job analysis, as they are often confused with each other (Van Cott and Paramore, 1988). A job consists of all of the tasks performed by a given person, position, or job category. Thus, whether a job or task analysis is done depends on the problem being examined. When a system has become operational, positions will exist and tasks will have been assigned to each position. At that point, a job analysis, rather than a task analysis is needed if the problem is one of identifying the skills and knowledge requirements of the job to verify the completeness of a training course for that job (Van Cott & Paramore, 1988).

Agribusiness Education Research

Consistent with the first step by V-TECS in its job analysis procedure, an examination of literature was done to determine the extent to which other analyses had been conducted to develop lists of potential knowledge and skills associated with the position being analyzed (Finch & Crunkilton, 1993). Most job analysis studies conducted to identify knowledge and skills needed by workers in the agricultural industry have concentrated on high school vocational agriculture

for skilled and semi-skilled positions. Among them is a very comprehensive analysis conducted by McClay (1978), in which essential competencies needed for entry-level and advancing positions in agriculture and agribusiness were identified and validated. He used job and task analysis to identify the essential competencies required in seven agriculture and agribusiness occupational areas. These competencies were subsequently validated by local and national Employer/Employee Review Groups (EERG) of experts.

Burnett (1980) cites research by McCracken and Yoder to determine a common core of skills needed in agribusiness and natural resources. Twenty-eight occupations in horticulture, forestry, natural resources, agricultural supply and service, agricultural mechanics, agricultural products processing, and agricultural production were identified in that study. All of them were either skilled or semi-skilled jobs.

In a study to assess what personal characteristics, and home and school background were prerequisites to successful agribusiness employment, Van Shelhamer and Bishop (1984) conducted a mail questionnaire survey of agribusinesses in the state of Montana. They concluded that the personal characteristics most desired in agribusiness employees were honesty; willingness to fulfill obligations; ability to listen, speak, and write effectively; ability to follow orders; and being on time and using time effectively. Their study also found that prospective employees with farm or ranch backgrounds were preferred and that

the chance of obtaining employment in Montana agribusinesses was greatly increased by two years of post-secondary education.

The literature shows an increasing international concern for servicing the agribusiness sector with targeted educational programs. For several years successful agribusiness programs have been conducted in the US and Canada (Woolverton & Torok, 1987; Hawkins & Dymond, 1991). Robertson (1989) anticipated the introduction of agribusiness courses in seven Australian colleges and universities within three years beginning in 1990-91. The current study is a reflection of this international concern.

The Five-year Plan for Food and Agriculture by the Joint Council of Food and Agricultural Sciences, USDA, has as one of its goals to strengthen higher education degree programs in food and agriculture to increase the number of professionals at the forefront of knowledge and technology. To achieve this, one of its major objectives is to encourage colleges and universities to pursue curricular revisions and development to meet the society's current and future agricultural and agribusiness employment needs (Coorts, 1987).

Commenting on increased interest by higher education in agribusiness programs, Schroder (1989) suggested that a legitimate academic concern was the extent to which agribusiness teaching was supported by a solid research foundation. A wide cross-section of research has addressed the issue. The most frequent citation in respect to agribusiness managerial positions is the Agribusiness Management Aptitude and Skills Survey (AGRI-MASS). These

include references in NACTA Journal (Barkley, 1991; Blank, 1987; Harris, 1989), Agribusiness (Preston & Broder, 1990; Schroder, 1989; Howard, Litzenberg, Schneider, & Fairnie, 1990; Litzenberg & French, 1989; Wallace, 1989; Fairnie, Stanton & Dobbin, 1989; Sonka & Hudson, 1989; Litzenberg & Schneider, 1988), The Black Collegiate (Kazi-Ferrouillet, 1990), Journal of Agricultural Economics (Litzenberg & Schneider, 1987b; Litzenberg, Gorman, & Schneider, 1983), and Canadian Journal of Agricultural Economics (Howard, 1989). AGRI-MASS is the result of original work by Litzenberg and Schneider (1987a, 1987b, 1988) and provides a comprehensive inventory of knowledge and skills focused on managerial positions in agribusiness. Two other inventories cited in the literature (Fairnie, Stanton & Dobbin, 1989; Harris, 1989) are direct adaptations of AGRI-MASS.

Litzenberg and Schneider (1987a, 1987b, 1988) first approached the subject in a study of Texas cooperatives in 1983 (Litzenberg and Schneider, 1987b). Later, as the Agribusiness Management Aptitude and Skill Survey, (AGRI-MASS), they conducted a nationwide survey of 543 company representatives in 12 different types of agribusinesses to measure the important knowledge, skills, and characteristics of successful agribusiness managers (Litzenberg and Schneider, 1987b). Fairnie, Stanton and Dobbin (1989) in Australia and Howard (1989) in Canada used similar approaches to survey agribusinesses and agricultural education institutions to solicit the perceptions of managers and faculty on the attributes desired for entry level, middle level and senior level management

positions in agribusiness. The objectives of these surveys were to provide curriculum builders a base of necessary knowledge, skills and characteristics required for agribusiness managers and to create the initiative for developing the types of educational objectives that were shown to be important from survey responses.

In all three surveys, agribusiness managers identified interpersonal and communication skills as the most important. Technical skills and work experience were found to be significantly different in various agribusiness sub-sectors. Similarly, interpersonal characteristics and communications skills received the highest ranking when agribusiness sales personnel were asked to evaluate skills and characteristics needed for careers in agricultural sales (Harris, 1989). The low standard error for interpersonal characteristics in this particular study was an indication of the high level of agreement among respondents.

Howard, Litzenberg, Schneider, and Fairnie used data from the foregoing U.S., Canadian, and Australian studies (Litzenberg and Schneider, 1987b; Howard, 1989; Fairnie, Stanton & Dobbin, 1989) to conduct cross-cultural comparisons of the importance placed on aptitudes and skills required for general success in agribusiness management positions. Generally, the survey results were strikingly similar. The researchers concluded that an implication of these findings was that both academic programs and the requirements for successful agribusiness careers should be similar in the three countries. They also suggested that the low rating of such categories as technical skills, computer skills, and previous work

experience should not be interpreted as being unnecessary, but rather simply of lower average value (Howard, Litzenberg, Schneider, & Fairnie, 1990).

Preston and Broder (1990) conceptualized the problem rather differently from researchers who have used the AGRI-MASS format (Fairnie, Stanton, and Dobbin, 1989; Howard, 1989; Litzenberg and Schneider, 1987a, 1987b). They acknowledged the instrumentality of employer surveys in learning how various skills and competencies were valued in the agribusiness market place. However, they were critical of the treatment of personal attributes as separate and independent of one another. They suggested, instead, that each person possessed unique portfolios of skills and attributes that were offered to employers in the labor market. They designed a study to determine labor market values placed on these portfolios of skills and attributes and linked the personal and demographic characteristics that were associated with these portfolios. They used cluster analysis to define groups of individuals possessing similar job skill portfolios. Three clusters were generated, differing on the basis of five categories of skills: Business and Economics; Computer, Quantitative and Management Information; Technical Skills; Communication; and Interpersonal Characteristics. There were significant differences among the average earnings by incumbents falling in each cluster. The researchers concluded that the result was a measure of the value placed on differing clusters or portfolios of skills in the market place (Preston & Broder, 1990).

Sweigert (1971) suggested that there were three principal reference groups whose perceptions of educational needs were critical to determine which educational objectives were functional. These reference groups were students, educators, and consumers of the educational product, including employers. Accordingly, Broder and Houston (1986) surveyed both agribusiness firms and University alumni to provide documentation of the perceptions and needs of the agribusiness market place. Employers were asked to indicate the relative importance of various traits associated with a new recruit. In addition, employers were asked to identify skills found lacking in new recruits. Employers placed the most importance on communication skills (43%), leadership experience and work experience (22%), and business skills (15%). Only 2.3% of employers mentioned computer skills as deficient among recruits. Neal, Hammond, and Kreps (1991) conducted a survey of business and agriculture leaders and advisory committee members of The Ohio State University/Agricultural Technical Institute to assess the future curriculum needs in the associate of applied science degree programs. Computer skills, agribusiness management skills, written and oral communication skills, and personnel management skills were identified as the most important future needs of graduates.

Sjo, et al. (1973) reported that collaboration among faculty, students and alumni in program review and curriculum revision at Kansas State University resulted in the dropping of several traditional courses, reduced duplication among courses, introduction of new subject matter and deletion of obsolete subject

matter. They concluded that dropping and revising traditional courses was not without faculty apprehension but that proper administrative procedures could provide the atmosphere necessary to obtain such changes.

Summary

The foregoing review of literature is of general and specific relevance to the present study. Underlying the citations on job analysis is an emphasis on the importance of precise and accurate information in making personnel decisions and the efficiency of achieving this through job analysis. The present study is concerned with educational decisions. Specifically, it is concerned with content selection in curriculum development. The ultimate interest is to achieve a close match between curriculum offerings and job requirements of agribusiness entry-level managerial positions. Sanyal, et al. (1983) cited the absence of such a match as a critical source of inefficiency in higher education.

The literature provides procedural descriptions for deriving instructional content through job analysis. Two curriculum development approaches, DACUM and the U.S. Air Force approach, typified by the process employed by V-TECS, have been cited to illustrate educational applications of job analysis. An adaptation of V-TECS's step-wise process has been used to design the job analysis process in the present study.

Previous job analysis studies in agriculture and agribusiness have been cited to acknowledge their contribution to the general body of knowledge on agriculture and agribusiness curricula. Among these studies AGRI-MASS is of particular

significance to this study because the study uses the same data collection instrument. International application of AGRI-MASS has been noted as well. This provides the argument for including the present study in cross-cultural comparisons of educational requirements in agribusiness.

CHAPTER III

PROCEDURE

Population

Top and middle management personnel of agribusiness firms in Jamaica constituted the population of interest in this study. The frame for the study was the agribusiness firms listed in the 1991-92 issue of the Jamaica Telephone Directory. It was assumed that all agribusiness firms in the country were listed in the directory. There were 122 such firms, all of which were surveyed.

The decision to survey the full list of agribusiness firms was indicated by two considerations: the firms were spread over a relatively narrow geographic area, and secondly, it was necessary to assure adequate representation of various agribusiness types and sizes to be able to conduct different sub-sample analyses and plan any unique program response indicated by the data.

Instrumentation

The Agribusiness Management Aptitude and Skill Survey (AGRI-MASS) instrument (Appendix A) was used to collect data for the study. AGRI-MASS was designed and used in the United States by Litzenberg and Schneider (1987a; 1987b) to conduct a national survey of agribusinesses and also applied in similar studies in Australia (Fairnie, Stanton & Dobbin, 1989) and Canada (Howard 1989).

In the United States study, the instrument was distributed through trade associations. The researchers reported that 543 usable instruments were returned

from a wide representation of agribusiness firms. In the Canadian research it was reported that in order to assure confidentiality, some surveys were given to trade associations to address and mail. A total of 287 responses were received from 1,134 surveys distributed, for a response rate of 25 per cent. There was no indication of the number of surveys distributed in the Australian study. Surveys were sent to agribusiness managers making up the mailing list of Muresk Institute of Agriculture at Curtin University and to other persons selected by a local consulting firm. There were 345 completed surveys in that study.

AGRI-MASS comprises 74 competencies in six major skill areas: (A) Business and Economics, (20 skills); (B) Computer, Quantitative, and Management Information, (10 skills); (C) Technical, (9 skills); (D) Communication, (9 skills); (E) Interpersonal Qualities, (15 skills); and (F) Employment, Work, and General Experience (11 skills). The instrument employs skills, knowledge, and aptitude descriptors (Cornelius, 1988) which hold direct implications for curriculum content. In its initial development, the instrument was reviewed by more than 20 professional educators and pretested with industry representatives to assure the content validity of competency items (Litzenberg and Schneider, 1987b).

The instrument also solicits information about each participating firm and respondent, including the respondent's perceptions of the agribusiness employment outlook.

Variables

Agribusiness firms were grouped into types, according to the major business they did, and into sizes based on the number in their workforce. Firm type and size were the independent variables in the study. Four types of firms were identified: Produce Marketing; Agricultural Supply Sales; Meat, Dairy, Food, and Grain Processing; and Agricultural Finance. With regard to firm size, three groups were established: fewer than 40 employees (small), 40 to 99 employees (medium), and more than 99 employees (large).

Seventy-four skills, personal qualities and experiences making up the AGRI-MASS instrument provided a measure of curriculum priority and were treated as dependent variables.

Data Collection and Scoring

Three people, the researcher, one member of the faculty of the College of Agriculture and the Senior Agricultural Education Officer in the Ministry of Education, made independent personal visits with top and middle management personnel to collect data. Respondents were provided with the research instrument at the time of the visit and required them to complete the instrument at that time. Responses were scored as perceptions of the importance of the 74 AGRI-MASS skills in the areas of business and economics; computer, quantitative and management information; technical skills; communication; personal qualities; and employment, work and general experiences for entry-level agribusiness managers. Items 75 to 84 were added to the AGRI-MASS instrument to solicit

information on respondents' length of employment in the present position; linkages maintained between firms and educational institutions; preferred qualification of recruits; and respondent perceptions of present employment opportunities and future outlook in agribusiness. A maximum of two repeat visits were planned for subjects who did not complete the questionnaire on the first visit. Completed instruments were collected at the end of the visit. There were 107 complete interviews, a response rate of 88%. Of 15 nonrespondents, four firms were branches of the main firm and identified the same chief executive officer, and two firms were no longer in operation, and in the remaining nine cases, interviewers were unsuccessful in getting complete questionnaires by the third visit.

The AGRI-MASS instrument uses a ten-point Likert-type ascending scale in the range 0-9. The scale is anchored as follows:

irrelevant	0	about average	5
very slightly important	1	slightly above average	6
much below average	2	above average	7
below average	3	much above average	8
slightly below average	4	extremely important	9

Data Analysis

The study used two principal designs to carry out the required analyses. The first was used to generate aggregate data of the agribusiness firms and respondent profiles, and statistical data describing the perceived importance of

seventy-four agribusiness tasks, personal qualities, and experiences. The latter were measured on a continuous scale.

The occurrence of unequal numbers of observations for different combinations of variables created an unbalanced design and required the use of the General Linear Model (GLM) procedure, the second design used in the study (SAS Institute, Inc., 1989). The procedure generated the descriptive statistics required to meet objective 2 in the form of least squares mean (LSM) importance scores. Also known as population marginal means, least squares means are the expected values of class or sub-class means expected for a balanced design. Their computation involves each class variable with all covariates held at their mean values. Least squares mean importance scores were ranked to indicate the relative importance of each within its skill area.

Importance ratings of individual job skills were compared by type and size of firm. The Tukey pairwise multiple comparison technique was used to conduct tests of statistical significance among means. A significance level of $p \leq 0.05$ was established.

The existing curriculum of the College of Agriculture was reviewed and compared with important AGRI-MASS skills to assess its relevance to employment needs and to suggest revisions. An importance score of 4.0 (slightly below average on the AGRI-MASS interpretive scale) or higher was established as the minimum for specific skills to be considered for inclusion in the curriculum.

The process of curriculum review involved an analysis of course descriptions (Appendix B) and tabulation of specific content which matched AGRI-MASS skills meeting the criterion score for curriculum inclusion. Numerical comparisons in the form of percentage of match between curriculum content and survey skills were used as index of relevance of the curriculum.

CHAPTER IV

RESULTS AND DISCUSSION

Introduction

The results of the study were based on 107 responses from 74 persons in top management positions and 33 middle managers. Tables 2 and 3 show the distribution of respondents by type and size of firm, respectively.

Table 2

Distribution of Respondents by Type of Firm

Type of Firm	Number of Firms	Percent of Firms
Produce marketing	27	25
Agricultural supplies	26	24
Meat, dairy and grain processing	36	34
Agricultural finance	18	17
Total	107	100

Table 3

Distribution of Respondents by Size of Firm

Number of Employees	Number of Firms	Percent of Firms
Fewer than 40	37	35
40 - 99	41	38
More than 99	29	27
Total	107	100

The breakdown of respondents by years of experience in the same position was less than 5 years, 17.8%; 5-10 years, 46.7%; 11-15 years, 29.9%; and over 15 years, 5.6 %. Seventy percent of firms represented in the study did not maintain any links with educational institutions while 30% maintained such linkages. Present opportunities for employment in agribusiness were perceived to be very good by 22.4% of respondents and good by 71.1%. Six respondents (5.6%) were uncertain about present opportunities and one person (.9%) thought opportunities were poor. Respondents' views of future employment opportunities in agribusiness were 15.5%, very good and 78% good. Seven persons (6.5%) were uncertain about future employment opportunities. No one viewed future employment opportunities as poor or very poor. Respondents' preference in hiring decisions were, respectively, for persons holding a university degree (58.9%), graduates of the College of Agriculture (29.9%) and graduates of the College of Arts, Science and Technology (10.3%). One respondent (.9%) preferred to hire agricultural secondary school graduates.

Seventy-nine percent of respondents were unable to judged the preparation of graduates of the College of Agriculture vis-a-vis other employees who had not received similar training. College of Agriculture graduates were judged by 10.5% of respondents to be better prepared while 6.7% judge their level of preparation to be about similar. Four respondents (3.8%) thought that College of Agriculture graduate were less well prepared for the job than other employees who had not undergone similar training.

Objective 1

Skills in the area of communication were perceived to be the most important. The order of importance of the other skill areas was personal qualities; business and economics; technical; employment, work and general experiences; and computer, quantitative and management information. Table 4 shows the ranking of skill areas. In studies conducted in the United States (Litzenberg and Schneider, 1987b), Canada (Howard, 1989) and Australia (Fairnie, Stanton and Dobbin, 1989) personal qualities, communication skills, business and economic skills, and employment, work and general experiences were ranked first, second, third, and sixth, respectively. Computer, quantitative and

Table 4

Ranking of Importance Scores of Agribusiness Skill Areas

Rank	Skill Area	Mean Importance Scores[1]	Standard Deviation
1	Communication	7.65	0.75
2	Personal Characteristics	6.94	0.87
3	Business & Economics	5.85	0.83
4	Technical Skills	5.31	1.00
5	Work, Employment & General Experience	5.13	0.93
6	Computer, Quantitative & Management Information	2.98	1.87

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important

management information skills were ranked fifth in the United states and Canada and fourth in Australia; technical skills were ranked fifth in the United States and Canada and fifth in Australia.

Table 5 shows the scores and ranks of individual communication skills. The top skills in the group are related to transmitting technical information orally (D2) and in writing (D1). To be able to give clear and concise instructions (D3), related to on-the-job supervision, is the third most highly rated communication skill. The least important communication skill was preparing and making an oral presentation (D9).

Table 5

Mean Importance Score and Rank of Communication Skills for all Firms

	Communication Skills	Mean[1]	Std Dev	Rank
D2	Speak clearly & concisely on technical information	8.39	.82	1
D1	Write technical reports, memos, and letters	8.35	1.06	2
D3	Give clear & concise instructions to others	8.12	.93	3
D4	Express creative ideas in writing	7.58	1.32	4
D6	Read and understand specific technical information	7.48	1.16	5
D7	Listen to & carry out instructions	7.45	1.10	6
D5	Express creative ideas orally	7.40	1.14	7
D8	Listen to & summarize lengthy oral presentations	7.14	1.29	8
D9	Prepare & deliver oral presentations	7.00	1.37	9
	Overall	7.65	0.75	1

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important

Training in communication skills has focused on formal courses in writing and rules of grammar. The data support this focus but, in addition, listening, speaking, summarizing, and making formal oral presentations were perceived to be highly important. The implication is that agribusiness training programs may be enhanced by increasing the content of communication courses or activities in the curriculum.

Employment in the managerial position will require graduates to apply people skills. They make up many of the top-rated skills in the area of personal qualities (Table 6).

Table 6

Mean Importance Score and Rank of Personal Qualities for all Firms

	Personal Qualities	Mean[1]	Std Dev	Rank
E13	Work without supervision	7.60	1.10	1
E5	Self-motivation	7.58	1.05	2
E7	Business and work ethics	7.47	1.04	3
E4	Positive work attitude	7.39	1.32	4
E1	Provide leadership and make decisions	7.31	1.12	5
E3	Work with others in problem-solving	7.14	1.23	6
E15	Loyalty to the organization	7.05	1.46	7
E8	Work under varied conditions	7.03	1.13	8
E6	Self-confidence	6.97	1.45	9
E11	Apply technical skills and problem-solving	6.90	1.33	10
E2	Manage people and delegate responsibility	6.85	1.45	11
E10	Select and supervise other employees	6.83	1.37	12
E9	Recognize business opportunity	6.70	1.43	13
E12	Take and defend position	6.56	1.49	14
E14	Raise capital for business ventures.	5.57	2.21	15
	Overall	6.94	0.87	2

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important

The most important skill in the group was a professional attribute -- work without supervision (E13). Among the four most important qualities were three personal attributes: positive work attitude (E4), self-confidence (E6), business and work ethics (E7). It has been argued that it may be difficult to teach these skills in the classroom (Barkley, 1991) and that educational institutions can only screen for personal qualities, as opposed to the skills that can be enhanced through education (Howard, 1989). Harris (1989) argued instead that besides developing these qualities in the classroom, student involvement in campus and community activities were avenues to improve their personal and people management skills. Schroder (1989) said that production of graduates with these skills could best be achieved by creating an environment, inside and outside the classroom, in which the student is given the chance to develop and practice these skills. Fairnie, Stanton and Dobbin (1989) suggested that teaching these qualities is both possible and legitimate and that the curriculum must include objectives and learning experiences designed to elicit such qualities as high moral and ethical standards, team skills, self-confidence, and loyalty to the firm. They suggested that extra-curricular activities, student interaction with their peers and the influence of teachers were ways to effectively develop these skills.

Skills in the area of business and economic skills were ranked third in importance. This is similar to results obtained by Litzenberg and Schneider (1987b), Howard (1989) and Fairnie, Stanton and Dobbin (1989). Skills in finance (A1), accounting (A2), economics (A5, A13, A15, A20) and human

resource management (A6, A16), and knowledge of national (A8, A10) and international (A9, A11, A12) business were some of the needs identified in the area of business and economics. The most important requirement in the group was financial skills (Table 7). The perceived importance of knowledge in international trade and export policy (A11), international political and economic

Table 7

Mean Importance Score and Rank of Business and Economic Skills for all Firms

	Business and Economic Skills	Mean[1]	Std Dev	Rank
A1	Read and use financial statements	6.57	1.52	1
A15	Monitor and evaluate objectives and goals	6.22	1.62	2
A7	Micro (firm/industry) economics	6.21	1.35	3
A8	Domestic (Jamaica) macro economics	6.18	1.56	4
A4	Marketing administration	6.17	1.71	5
A6	Human resource planning and control	6.14	1.51	6
A16	Coordinate human and physical resources	6.12	1.68	7
A2	Understand accounting concepts	6.07	1.45	8
A18	Inventory management Systems	6.04	1.81	9
A3	Professional selling techniques	6.01	1.96	10
A10	Jamaican agricultural policy	5.81	1.52	11
A9	International macro economics	5.77	1.83	12
A20	Identify and manage risk and uncertainty	5.76	1.27	13
A13	Identify objectives and goals of the firm	5.76	1.79	14
A5	Understand corporate finance	5.67	1.87	15
A12	Political and economic forces on business	5.58	1.51	16
A14	Business policies programs	5.57	1.93	17
A11	International trade and export policy	5.33	1.37	18
A19	Business organizational structure	5.10	1.45	19
A17	Process and product layout and design	5.10	2.24	20
	Overall	5.85	0.83	3

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important

forces and their effects on local business (A12) is justified by Jamaica's reliance on international trade, the international structure and ownership of many

agribusiness firms in the country, global agribusiness competition, and membership and participation in many international organizations and agreements.

The skills within the technical area were quite diverse in their range of applications to livestock production (C1) general and specialized crop production (C2, C3), soil science (C4), food processing technology (C6), biotechnology (C5), food transportation and distribution systems (C7) and engineering technology (C8, C9) (Table 8).

Table 8

Mean Importance Score and Rank of Technical Skills for all Firms

	Technical Skill	Mean[1]	Std Dev	Rank
C2	General crop production systems	6.00	2.75	1
C1	General livestock and meat production systems	5.75	2.62	2
C3	Specialized crop production systems	5.74	2.67	3
C5	Bio-science, biotechnology and bio-chemistry	5.69	1.63	4
C4	Soil chemistry and characteristics	5.63	2.15	5
C7	Food transportation and distribution systems	5.45	2.23	6
C8	Engineering technology of production processing machinery	5.19	1.89	7
C6	Food science and processing technology	5.03	2.36	8
C9	Computer controlled mechanical processes	3.74	2.30	9
	Overall	5.31	1.00	4

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important

Given the wide range of application of these skills, it was anticipated that the perceived importance of individual skills would differ among sectors of the agribusiness industry. The top-rated skills in the group were related to crop (C2, C3) and livestock (C1) systems. Since meat, dairy and grain processing firms represented the highest proportion of respondents (Table 2), it is possible that this result shows the bias of these types of firms. In the comparable studies conducted in the United States (Litzenberg and Schneider, 1987b), Canada (Fairnie, Stanton and Dobbin, 1989) and Australia (Howard, 1989), crop production systems (C2) were ranked first in all three countries. The Canadian and Australian studies ranked livestock production systems (C1) second, while the United States study ranked it fourth. Of less importance in the present study were skills in engineering and processing technology. All skills but one (C9), met the criterion for inclusion in the curriculum.

All skills but one in the area of employment, work and general experiences met the criterion for inclusion in the curriculum. The single exception shown in Table 9 was experience in government or public affairs (F6). Not surprisingly, the top-rated experience was perceived to be previous employment in domestic agribusiness firms (F2) and farm work (F1). Other highly rated experiences were participation in extra-curricular activity in college and cooperative internship. By their nature, it is presumed that employment and work experiences would be gained by working in organizations and are, therefore, not normally available as part of the educational process. Although most graduating students would not

Table 9

Mean Importance Score and Rank of Employment, Work and General Experiences for all Firms

	Employment, Work and General Experiences	Mean[1]	Std Dev	Rank
F2	Domestic (Jamaican) agribusiness firm	6.35	1.56	1
F1	Farm work	6.31	2.02	2
F7	Industry internships/cooperative work-study	5.61	1.62	3
F10	Extra curricular activities in college	5.60	1.38	4
F11	General education -- humanities	5.51	1.44	5
F9	Developing business plan	5.33	1.91	6
F8	Personnel training functions	5.04	1.27	7
F3	Employment in financial institution	4.73	2.16	8
F5	International agribusiness firm	4.45	1.77	9
F4	Non-agricultural retail business	4.14	1.91	10
F6	Government/public affairs	3.44	2.24	11
	Overall	5.13	0.93	5

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important

have had employment opportunities to bring such experiences to their first job, students should be aware of the importance of these experiences in order to improve their personal competitiveness by their choice of cooperative internship, practical training and short-term employment.

Skills in the area of computer, quantitative and management information were ranked lowest in importance (Table 10). The prominent role of computers in business and society is perhaps not recognized in these results. There were only four skills which met the criterion for inclusion in the curriculum. This finding indicated that skills in application software (B1), computerized accounting

(B2), statistical and mathematical techniques (B8), and quantitative managerial decision-making (B9) were important requirements. The data indicate that these skill are important on their own, but, in addition, the applied nature of these skills permits their reinforcement if, apart from the computer courses offered in the curriculum, relevant computer activities were incorporated in other subjects designed to teach skills such as accounting (A2), micro economics (A7), macro economics (A8, A9), inventory management (A18) in the business and economics area, and for preparing reports, memos and letters (D1) in the area of communication.

Table 10

Mean Importance Score and Rank of Computer, Quantitative and Management Information Skills for all Firms

	Computer, Quantitative and Management Information Skills	Mean[1]	Std Dev	Rank
B1	General business software	5.78	1.54	1
B9	Quantitative managerial decision making	5.04	1.95	2
B2	Computerized accounting systems.	4.64	2.19	3
B8	Interpret and use math & statistical methods	4.36	2.57	4
B10	Telecommunication functions	3.74	2.11	5
B4	Communicate with programmers	2.20	2.20	6
B7	Use local area network (LAN)	1.54	2.07	7
B6	Supervise computer personnel	1.39	2.07	8
B3	Write hardware and software specifications	1.20	1.20	9
B5	Write computer programs	0.68	1.68	10
	Overall	2.98	1.87	6

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important

Given the pervasiveness of computers in everyday business, the low rating of most of the computer and quantitative skills was surprising. In comparable AGRI-MASS studies in the United States (Litzenberg and Schneider, 1987b), Canada (Howard, 1989) and Australia (Fairnie, Stanton and Dobbin, 1989) these skills were ranked fifth in the first two studies and fourth in the third.

Overall, 66 (89%) of the 74 specific skills examined in the study received importance scores of 4.0 or higher and, thus, met the criterion to be considered for inclusion in the curriculum. Based on this criterion, the data for objectives 2 and 3 were analyzed on 66 skills.

Objective 2

Presented in Table 11 are the results of analysis of 66 skills within six areas, by type and size of firm. Significant differences were greatest for business and economic skills and technical skills and least for communication skills and personal qualities. These results suggest that in addition to respondents' perception of their high level of importance, they shared the highest level of consensus about the importance of communication skills and personal qualities, type or size of firm notwithstanding. The high incidence of significant differences noted in respect of skills in the business and economics area and the technical area indicates that these skills were not perceived to be uniformly applicable to firms of different types or sizes. In a review of similar differences in industry requirements obtained in a previous AGRI-MASS study, Litzenberg and

Schneider (1987b) argued that agribusiness programs should have a precise focus in terms of demand for students by industry segments.

Table 11

Number of Skills Meeting Criterion for Curriculum Consideration and Showing Statistical Significance by Type and Size of Firm.

Skill Area	Number of Skills With Scores ≥ 4.0	Number of Skills Showing Statistical Significance[1]	
		Type	Size
Communication	9	0	3
Personal Qualities	15	2	1
Business and Economics	20	7	10
Technical	8	6	2
Employment, Work & General Experiences	10	3	3
Computer, Quantitative & Management Information	4	3	3
Total	66	21	22

[1]Level of significance = $p \leq 0.05$

Tables 12 and 13 show the analysis of communication skills by type and size of firm, respectively. The data in Table 12 show that there was no significant difference in the perceived importance of specific communication skills type of firm.

When size firm was considered (Table 13), two aspects of communicating technical information -- writing (D1) and speaking (D2) -- were perceived to be of significantly higher importance to small and medium firms than to large firms.

Table 12
Least Squares Mean Importance Scores for Communication Skills by Type of Agribusiness Firms in Jamaica

	Communication Skills	Mean Importance Scores by Type of Agribusiness Firm[1]					
		Marketing	Sales	Processing	Finance	F	p
D2	Speak clearly and concisely on technical information	8.35	8.45	8.21	8.44	0.50	.68
D1	Write technical reports, memos, and letters	8.27	8.45	8.20	8.27	0.28	.83
D3	Give clear and concise instructions to others	7.85	8.23	8.21	8.00	1.10	.35
D4	Express creative ideas in writing	7.38	8.05	7.32	7.47	1.67	.17
D6	Read and understand technical information	7.16	7.71	7.59	7.42	1.14	.33
D5	Express creative ideas orally	7.13	7.55	7.46	7.53	0.73	.53
D7	Listen to and carry out instructions	7.12	7.72	7.48	7.42	0.34	.26
D8	Listen to and summarize lengthy oral presentations	6.95	7.55	7.02	6.97	1.16	.32
D9	Prepare and deliver oral presentations	6.84	7.31	6.70	7.27	1.15	.33

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important

Table 13

Least Squares Mean Importance Scores for Communication Skills by Size of Agribusiness Firms in Jamaica

		Mean Importance Scores by Size of Agribusiness Firm[1]				
	Communication Skills	Small	Medium	Large	F	p
D1	Write technical reports, memos, and letters[2]	8.47[a]	8.71[a]	7.71[b]	7.40	.001
D2	Speak clearly and concisely on technical information[2]	8.38[a]	8.76[a]	7.95[b]	8.50	.0004
D3	Give clear and concise instructions to others[2]	7.80[a]	8.49[b]	7.95	6.30	.002
D4	Express creative ideas in writing	7.43	7.96	7.28	2.58	.08
D7	Listen to and carry out instructions	7.37	7.60	7.33	0.59	.55
D5	Express creative ideas orally	7.30	7.42	7.53	0.26	.77
D6	Read and understand specific technical information	7.28	7.60	7.53	0.73	.48
D9	Prepare and deliver oral presentations	7.00	7.26	6.84	0.79	.45
D8	Listen to and summarize lengthy oral presentations	6.91	7.37	7.09	1.17	.31

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important
[2]Tukey Test: values within the same row with unlike superscripts are significantly different ($p < 0.05$)

The ability to give clear and concise instructions (D3) was significantly more important to medium firms than to small firms. The relatively high scores of 7.0 or higher received by each skill within the area of communication discount any practical significance in the differences identified. All nine communication skills met the criterion for inclusion in the curriculum.

Communication skills were ranked second overall to personal qualities in the comparable AGRI-MASS study conducted among Canadian agribusiness firms. However, they were ranked in first position by financial and chemical, drugs, and fertilizer sales firms. Firms with 200 or fewer employees ranked communication skills higher than personal qualities and the reverse for firms with more than 200 employees. These results were the same in a comparison of respondents from academic institutions and respondents from agribusiness firms (Howard, 1989). This was the only other AGRI-MASS study reporting these comparisons.

Tables 14 and 15 show the analysis of personal qualities by type and size of firm, respectively. The data (Table 14) show that ability to select and supervise employees (E10) was significantly more important to managers in processing firms than to managers of marketing, sales or financial firms. The ability to apply technical knowledge in problem-solving (E11) was perceived to be significantly more important to sales and processing firms than marketing firms.

One item of statistical significance was identified for firms of different sizes (Table 15). The ability to recognize business opportunity (E9) was perceived to be more important to small firms than to large firms.

Table 14

Least Squares Mean Importance Scores for Personal Qualities by Type of Agribusiness Firms in Jamaica

	Personal Qualities	Mean Importance Scores by Type of Agribusiness Firm[1] Marketing	Sales	Processing	Finance	F	p
E5	Self-motivation	7.49	7.73	7.54	7.71	0.37	.77
E7	Business and work ethics	7.30	7.71	7.53	7.29	0.87	.45
E13	Work without supervision	7.24	7.62	7.89	7.64	1.68	.17
E4	Positive work attitude	7.16	7.78	7.29	7.49	1.06	.37
E3	Work with others in problem solving	7.13	7.60	6.99	6.87	1.54	.21
E1	Provide leadership and make decisions	7.00	7.72	7.24	7.26	1.87	.13
E6	Self-confidence	6.90	7.42	6.88	6.64	1.18	.32
E8	Work under varied conditions	6.88	7.27	7.04	6.95	0.55	.65
E15	Loyalty to the organization	6.64	7.49	7.09	7.04	1.51	.21
E2	Manage people and delegate responsibility	6.49	7.37	6.88	6.61	1.82	.14
E12	Take and defend position	6.38	6.64	6.81	6.04	1.03	.38
E10	Select and supervise other employees[2]	6.31[a]	6.67[a]	7.36[b]	6.66[a]	2.88	.03
E9	Recognize business opportunity	6.29	6.48	6.83	7.11	1.75	.16
E11	Apply technical skills problem solving[2]	6.22[a]	7.21[b]	7.37[b]	6.38	5.26	.002
E14	Raise capital for business ventures	5.67	5.45	5.08	6.33	1.07	.36

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important
[2]Tukey Test: values within the same row with unlike superscripts are significantly different ($p < 0.05$)

Table 15

Least Squares Mean Importance Scores for Personal Qualities by Size of Agribusiness Firms in Jamaica

	Personal Qualities	Mean Importance Scores by Size of Agribusiness Firm[1] Small	Medium	Large	F	p
E13	Work without supervision	7.75	7.36	7.68	1.32	.27
E7	Business and work ethics	7.42	7.45	7.50	0.04	.96
E4	Positive work attitude	7.38	7.26	7.65	0.61	.54
E5	Self-Motivation	7.38	7.52	7.67	0.19	.82
E1	Provide leadership and make decisions	7.37	7.39	7.16	0.34	.71
E15	Loyalty to the organization	7.27	6.78	7.14	1.16	.31
E3	Work with others problem-solving	7.10	7.10	7.25	0.11	.89
E9	Recognize business opportunity[2]	7.10[a]	6.76	6.17[b]	3.27	.04
E10	Select and supervise other employees	7.06	6.70	6.49	1.29	.27
E11	Apply technical skills in problem-solving	7.04	6.88	6.46	1.36	.26
E6	Self-confidence	7.02	6.96	6.87	0.06	.94
E2	Manage people and delegate responsibility	6.91	6.69	6.91	0.28	.75
E8	Work under varied conditions	6.72	7.18	7.20	1.86	.16
E12	Take and defend position	6.60	6.62	6.18	0.66	.51
E14	Raise capital for business ventures	5.49	5.93	5.50	0.46	.63

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important
[2]Tukey Test: values within the same row with unlike superscripts are significantly different ($p < 0.05$)

The relative lack of statistical significance identified among firms of different type and size in respect of personal qualities is perhaps an indication of the general applicability of appropriate personal qualities to all firms. In the instances of statistical significance identified, each skill was perceived to be of above average importance.

The two skills showing statistical difference among types of firms -- supervisory (E10) and problem-solving (E11) abilities -- are important functions of the managerial position. Their high scores should discount any differences in the training requirements among different types of firms for these particular personal qualities. All agribusiness managers should be able to interact with people (E3) effectively, as well as motivate, lead (E1) and direct subordinate employees (E10). Ethics (E7) in the business community are very important in the functioning of society. All graduates planning an agribusiness career should develop the personal qualities identified to be important to permit them to function effectively in society.

Tables 16 and 17 show the analysis of business and economic skills by type and size of firm, respectively. In Table 16, the ability to use financial statements (A1) was perceived to be significantly more important to financial firms than to marketing and processing firms. Significant difference in the importance of this skill was also identified between sales and marketing firms. The skill was significantly more important to sales firms. Accounting skill (A2) was perceived to be significantly more important for financial firms than marketing, sales or

Table 16

Least Squares Mean Importance Scores for Business and Economic Skills by Type of Agribusiness Firms in Jamaica

	Business and Economic Skills	Mean Importance Scores by Type of Agribusiness Firm[1] Marketing	Sales	Processing	Finance	F	p
A4	Marketing administration[2]	6.70[a]	6.25	5.97[b]	5.38[b]	3.61	.05
A6	Human resource planning and control	6.23	6.71	6.61	5.68	1.83	.14
A8	Domestic (Jamaica) macro economics	6.18	6.31	5.71	6.68	1.57	.20
A7	Micro (firm/industry economics	6.06	6.45	5.95	6.49	1.05	.37
A3	Professional selling techniques[2]	6.03[a]	7.40[b]	5.49[a]	4.89[a]	9.61	.0001
A1	Read and use financial statement[2]	5.64[a]	6.87[bc]	6.56[ab]	7.32[c]	6.08	.0008
A16	Coordinate human and physical resources	5.62	6.66[a]	6.56[a]	5.28[b]	4.03	.009
A18	Inventory Management Systems[2]	5.61[a]	6.89[b]	6.30[a]	4.62[a]	7.78	.0001
A12	National and international political and economic forces on business operations	5.59	5.58	5.44	5.22	0.62	.60
A9	International macro economics	5.52	5.46	5.73	6.27	0.84	.47
A13	Identify objectives and goals of the agribusiness firm	5.47	6.10	5.67	5.40	0.79	.50
A15	Monitor and evaluate objectives and goals	5.47	6.84	6.14	6.57	3.84	.11
A5	Understand corporate finance	5.46	5.83	5.40	5.95	0.49	.69
A2	Understand accounting concepts[2]	5.45[a]	6.08[a]	5.91[a]	7.18[b]	5.93	.0009
A10	Current and historic Jamaican agricultural policy	5.45	5.92	5.47	6.17	1.03	.36

Table 16 continued

A11	Current and historic international trade and export policy and procedures	5.42	5.11	5.19	5.64	0.68	.56
A20	Identify and manage risk and uncertainty[2]	5.17[a]	6.10[b]	5.95	5.61	3.06	.03
A19	Business organizational structure	5.15	4.93	5.02	5.29	0.25	.86
A14	Business policies and programs	5.01	5.85	5.51	5.90	1.18	.32
A17	Process and product layout and design	4.74	5.19	5.43	5.18	0.46	.71

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important
[2]Tukey Test: values within the same row with unlike superscripts are significantly different ($p < 0.05$)

Table 17

Least Squares Mean Importance Scores for Business and Economic Skills by Size of Agribusiness Firms in Jamaica

		Mean Importance Scores by Size of Agribusiness Firm[1]				
	Business and Economic Skills	Small	Medium	Large	F	p
A1	Read, understand and use financial statement	7.03	6.60	6.17	2.47	.08
A4	Marketing administration[2]	6.78[a]	6.03[b]	4.41[b]	4.80	.009
A10	Current and historic Jamaican agricultural policy[2]	6.72[a]	5.24[b]	5.66[b]	9.70	.0001
A8	Domestic (Jamaica) macro economics	6.69	6.25	5.72	2.77	.06
A3	Professional selling techniques[2]	6.67[a]	5.71[b]	5.46[b]	4.40	.01
A15	Monitor and evaluate objectives and goals	6.68	6.01	6.07	1.90	.15
A7	Micro (firm/industry) economics	6.55	6.28	5.86	1.70	.18
A2	Understand accounting concepts	6.37	6.21	5.88	0.85	.42
A5	Understand corporate finance[2]	6.32[a]	5.71	4.94[b]	3.70	.02
A9	International macro economics[2]	6.31[a]	5.97[a]	4.95[b]	3.90	.02
A14	Business policies and programs[2]	6.24[a]	5.50	4.95[b]	3.20	.04
A13	Identify objectives and goals of the firm[2]	6.08[a]	6.12[a]	4.77[b]	5.00	.008
A20	Identify and manage risk and uncertainty.	6.06	5.73	5.33	2.28	.10
A16	Coordinate human and physical resources	5.94	5.97	6.18	0.17	.84
A12	National and international political economic forces on business operations	5.94	5.60	5.01	2.45	.09
A11	Current and historic international trade and export policy	5.90[a]	5.20	4.92[b]	0.05	.02
A6	Human resource planning and control	5.74	6.04	6.70	2.60	.07

Table 17 continued

A18	Inventory Management Systems[2]	6.57[a]	5.88[b]	5.11[b]	5.30	.006
A19	Business organizational structure[2]	5.41[a]	5.10	4.78[b]	1.19	.03
A17	Process and product layout and design	4.41	5.17	5.82	2.68	.07

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important
[2]Tukey Test: values within the same row with unlike superscripts are significantly different ($p < 0.05$)

processing firms. Professional selling (A3) was significantly more important to sales firms than to marketing, processing and financial firms. This same skill was significantly more important for small firms than for medium and large firms (Table 17).

A knowledge of marketing administration (A4) was significantly more important for marketing firms compared with processing and financial firms (Table 16). Co-ordination of human and physical resources (A16) was perceived to be significantly more important to sales and processing firms than financial firms (Table 16). Inventory management skills (A18) was significantly more important to sales firms than to marketing, sales and financial firms. Comparison of the data by size of firms (Table 17) shows that a knowledge of corporate finance (A5) was perceived to be significantly more important to small firms compared to large firms. A knowledge of international macro economics (A9) was more important to small and medium firms than to large firms. Similarly, knowledge of current and historical Jamaican agricultural policy (A10), current and historical international trade and export policy (A11), abilities to develop business policies and programs (A14), and identify objectives and goals (A13) were significantly more important to small firms. The latter skill was also significantly more important to medium firms than large firms. Lastly, inventory management skills (A18) was more important to small firms than medium or large firms.

Tables 18 and 19 show the analysis of variance of technical skills by type and size of firm, respectively. The perceived importance of six technical skills was significantly different among types of firms (Table 18). The wide variety of technical skills and the specificity of their application to the different types of businesses perhaps accounted for the high level of statistical significance perceived among these skills. Less difference was identified when the same set of skills were analyzed by size of firm (Table 19).

Significant difference was identified between marketing and processing firms for livestock and meat production skill (C1). The skill was perceived to be more important to managers of processing and financial firms than marketing firms. In the case of general crop production (C2), the skill was significantly more important to sales and financial firms than processing firms. A knowledge of specialized crop production systems (C3) was significantly more important to marketing and sales firms than processing firms. Significant difference also existed between sales and processing firms in respect of knowledge in soil chemistry (C4) and food processing technology (C6). The former skill was more important to sales firms and the latter more important for processing firms. Food transportation and distribution skill (C7) was significantly more important to processing firms than to sales and financial firms. When analyzed by size of firm, this skill was significantly more important to medium and large firms than small firms. Further analysis of specific technical skills by size of firm (Table 19)

Table 18

Least Squares Mean Importance Scores for Technical Skills by Type of Agribusiness Firms in Jamaica

	Technical Skills	Mean Importance Scores by Type of Agribusiness Firm[1]					
		Marketing	Sales	Processing	Finance	F	p
C3	Specialized crop production systems[2]	5.95[a]	6.99[a]	4.19[b]	6.44[a]	5.63	.001
C2	General crop production systems[2]	5.94	7.13[a]	4.69[b]	6.79[a]	4.12	.008
C4	Soil chemistry and characteristics[2]	5.81	6.66[a]	4.84[b]	5.20	3.68	.01
C5	Bio-science, biotechnology and bio-chemistry	5.55	6.27	5.67	4.94	2.27	.08
C7	Food transportation and distribution systems[2]	5.42	5.14[a]	6.21[b]	4.09[a]	3.83	.01
C8	Engineering technology of production and processing machinery	5.01	5.09	5.64	4.65	1.14	.33
C6	Food science and processing technology[2]	4.97	4.14[a]	5.97[b]	4.50	2.75	.04
C1	General livestock and meat production systems[2]	4.34[a]	5.85	6.23[b]	6.82[b]	4.12	.008

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important
[2]Tukey Test: values within the same row with unlike superscripts are significantly different ($p < 0.05$)

Table 19

Least Squares Mean Importance Scores for Importance Technical Skills by Size of Agribusiness Firms in Jamaica

		Mean Importance Scores by Size of Agribusiness Firm[1]				
	Technical Skills	Small	Medium	Large	F	p
C2	General crop production systems	6.47	6.04	5.90	0.38	.68
C3	Specialized crop production systems	6.16	5.66	5.87	0.38	.68
C4	Soil chemistry and characteristics	6.07	5.51	5.31	1.08	.35
C1	General livestock and meat production systems	5.70	6.02	5.71	0.18	.85
C5	Bio-science, biotechnology and bio-chemistry	5.60	5.80	5.42	0.42	.65
C6	Food science and processing technology	4.99	4.74	4.95	0.12	.89
C7	Food transportation and distribution systems[2]	4.34[a]	6.18[b]	5.11[b]	7.80	.0009
C8	Technology of production and processing machinery[2]	4.22[a]	5.76[b]	5.31[b]	6.90	.001

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important
[2]Tukey Test: values within the same row with unlike superscripts are significantly different ($p < 0.05$)

showed a knowledge of engineering technology (C8) and knowledge of food transportation and distribution systems to be significantly more important to medium and large firms than small firms.

Tables 20 and 21 show the analysis of employment, work and general experiences by type and size of firm. In Table 20, previous employment in financial institutions (F3) was significantly more important to financial firms than marketing and processing firms. Employment in a non-agricultural retail business (F4) was significantly more important to sales and processing firms than financial firms. The ability to develop a business plan (F9) was significantly more important to financial firms than marketing, sales or processing firms.

In the comparison of employment, work and general experiences by size of firm (Table 21), it was found that experience in farm work (F1) was more important to medium firms than to small firms. Previous employment in non-agricultural retail business (F4) and internship in industry or cooperative work study (F7) were significantly more important to small firms than medium and large firms.

Tables 22 and 23 show data from the analysis of computer, quantitative and general experiences by type and size of firm, respectively.

It has been indicated earlier that only 4 of 10 skills in the area of computer, quantitative and management information met the criterion for inclusion in the curriculum. They were general business software (B1), quantitative managerial decision-making (B9), computerized accounting systems (B2), interpretation and

Table 20

Least Squares Mean Importance Scores for Employment, Work, and General Experiences for Entry-level Managers by Type of Agribusiness Firms in Jamaica

	Employment, Work and General Experiences	Mean Importance Score[1] by Type of Agribusiness Firms				F	p
		Marketing	Sales	Processing	Finance		
F1	Farm work	6.66	6.29	5.66	6.93	1.84	.14
F2	Domestic (Jamaica) agribusiness firms	6.27	6.50	6.14	6.56	0.33	.80
F11	General education - humanities	5.84	5.12	5.52	5.28	1.22	.30
F10	Extra Curricular activities in college	5.69	5.52	5.32	5.83	0.58	.62
F7	Industry internship/Cooperative work-study	5.55	4.98	6.11	5.56	2.11	.10
F8	Personnel training functions	5.02	5.19	4.88	5.20	0.31	.82
F5	International agribusiness firm	4.83	4.27	4.02	5.18	1.89	.13
F9	Developing business plan[2]	4.77[a]	5.21[a]	4.79[a]	7.18[b]	8.86	.0001
F4	Non-agricultural retail business[2]	4.01	4.57[a]	4.49[a]	2.74[b]	3.91	.01
F3	Employment in financial institutions[2]	3.95[a]	4.77	4.42[a]	6.07[b]	4.01	.009
F6	Government/public affairs	3.34	3.44	3.03	4.37	1.89	.13

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important
[2]Tukey Test: values within the same row with unlike superscripts are significantly different ($p < 0.05$)

Table 21

Least Squares Mean Importance Scores for Employment, Work, and General Experiences by Size of Agribusiness Firms in Jamaica

	Employment Work and General Experiences	Mean Importance Scores by Size of Agribusiness Firm[1] Small	Medium	Large	F	p
F2	Domestic (Jamaica) agribusiness firm	6.28	6.54	6.29	0.31	.73
F7	Industry internship/Cooperative work-study[2]	6.23[a]	5.20[b]	5.22[b]	4.50	.01
F1	Farm work[2]	5.63[a]	6.99[b]	6.53	4.40	.01
F10	Extra curricular activities in college	5.53	6.01	5.23	2.60	.07
F9	Developing business plan	5.44	5.88	5.14	1.50	.22
F11	General education - humanities	5.37	5.86	5.09	2.27	.10
F8	Personnel training functions	5.32	4.88	5.01	1.00	.34
F4	Non-agricultural retail business[2]	4.66[a]	3.86[b]	3.34[b]	3.50	.03
F3	Employment in financial institutions	4.61	5.36	4.44	1.90	.14
F5	International agribusiness firm	4.26	4.48	4.98	1.00	.35

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important
[2]Tukey Test: values within the same row with unlike superscripts are significantly different ($p < 0.05$)

Table 22

Least Squares Mean Importance Scores for Computer, Quantitative, and Management Information Skills by Type of Agribusiness Firms in Jamaica

	Computer, Quantitative & Management Information Skills	Mean Importance Scores by Type of Agribusiness Firm[1]					
		Marketing	Sales	Processing	Finance	F	p
B1	General business software[2]	5.77[a]	5.50[a]	5.28[a]	7.14[b]	6.63	.0004
B9	Quantitative managerial decision-making[2]	4.43[a]	4.75[a]	4.88[a]	6.46[b]	4.85	.003
B2	Computerized accounting systems[2]	3.80[a]	4.61[a]	4.43[a]	6.04[b]	4.52	.005
B8	Interpret and use math and statistical methods	3.55	4.41	4.22	5.25	1.73	.16

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important
[2]Tukey Test: values within the same row with unlike superscripts are significantly different ($p < 0.05$)

Table 23

Least Squares Mean Importance Scores for Computer, Quantitative, and Management Information Skills by Size of Agribusiness Firms in Jamaica

	Computer, Quantitative and Management Information Skills	Mean Importance Score[1] by Size of Agribusiness Firm: Small	Medium	Large	F	p
B1	General business software	6.21	5.82	5.74	0.94	.39
B9	Quantitative managerial decision-making[2]	4.81[a]	5.65[b]	4.94	2.30	.01
B2	Computerized accounting systems[2]	4.14[a]	5.52[b]	4.50[a]	4.90	.01
B8	Interpret and use math and statistical methods[2]	3.87[a]	5.34[b]	3.87[a]	4.20	.01

[1]Scoring scale ranged from 0 = irrelevant to 9 = extremely important
[2]Tukey Test: values within the same row with unlike superscripts are statistically significant ($p < 0.05$)

use of mathematics and statistical methods (B8). When type of firm was considered, skills in general business software (B1), computerized accounting systems (B2) and quantitative managerial decision-making was more important to financial firms than marketing, sales or processing firms (Table 22).

Table 23 shows that skills in computerized accounting systems (B2) and mathematics and statistical methods (B8) were significantly more important to medium firms than small or large firms. Quantitative managerial decision-making (B9) was significantly more important to medium firms than small firms.

Objective 3

College of Agriculture core curriculum

To earn its three-year Associate Degree in Science, the College of Agriculture requires students to complete 123 credit units, one credit unit being the equivalent of one hour of classroom lecture, or two hours of laboratory practicals, per week per semester. Distribution of these credit units is shown in Table 24. The major portion of this distribution are 111 credit units of core courses, including six units of cooperative internship. There are in addition two categories of student activities provided by the college but not used in computing credit unit requirement. The first is an extensive program of farm practice conducted on the college farm, a requirement for all students. The second is a wide range of optional extra-curricular activities. Such activities were perceived by respondents to be important for entry-level managers.

Table 24

Course Requirement for Completing Associate Degree in Science Program of the College of Agriculture, Jamaica

Area of Study	Credit Units
Business and Economics	13
Computer and Quantitative	12
Technical Agriculture	33
Communication	12
Physical Science	12
Life Science	20
Social Science	3
Cooperative Internship	6
Electives	12
Total	123

Analysis of the description of each course offered by the College of Agriculture (Appendix B) showed that of 111 credit units of core courses were 79 credit units which (1) provided training in AGRI-MASS skills and (2) were perceived by respondents to be important to entry-level agribusiness managers. A further 20 credit units of core courses were in the area of the physical sciences and 12 credit units of natural sciences. These 32 credit units were not identified with specific counterpart skills in the AGRI-MASS list. An additional 29 credit units of instruction whose content were identified with specific AGRI-MASS skills are available through elective courses. Students are required to select 12 credit units of elective courses. The distribution of these courses, the number of credit units they provide and their associated AGRI-MASS skill areas are shown in Table 25.

Table 25

Classification of College of Agriculture Course Requirement into AGRI-MASS Skill Areas

AGRI-MASS Areas and COA Core Courses	Core Units	Elective Units
B8USINESS & ECONOMIC SKILLS	**13**	**14**
Fundamentals of Agricultural Economics	3	
Farm Business Management	4	
Agricultural Marketing	3	
Fundamentals of Program Development	3	
COMPUTER and QUANTITATIVE SKILLS	**12**	**0**
College Mathematics	3	
Introduction to Computer Science	3	
Fundamentals of Statistics	3	
Research Methodology	3	
TECHNICAL SKILLS	**33**	**15**
Animal Nutrition	3	
Livestock Production Practices	3	
Crop Production Practices	3	
Soil Management	3	
Farm Power and Machinery	3	
Introduction to Soil Science	4	
Principles of Livestock Production	3	
Plant Protection	4	
Principles of Crop Production	3	
Veterinary Science	4	
COMMUNICATION	**12**	**0**
Use of English	3	
Communication Skills	3	
Teaching Agriculture/Principles of Extension	3	
Research Methodology	3	
PERSONAL QUALITIES	**0**	**0**
WORK EMPLOYMENT & GENERAL EXPERIENCE	**9**	**0**
Cooperative Internship Education	6	
Sociology	3	
Farm Practice		
Extra Curricular Experience		

For both core courses and elective courses, the most numerous representation is the area of technical skills (Table 25). Training in technical skills is provided by 33 out of 79 credit units (42%) of core courses and 15 out of

29 credit units (52%) of elective courses classified in AGRI-MASS skill areas. Conversely, no course was identified with the delivery of skills in the area of personal qualities. Howard (1989) argued that by ranking technical skills lower than personal qualities and communication skills, respondents were indicating the prominence that these skills should receive in the curriculum. He suggested further that it was also possible that employers in business want employees with certain qualities and abilities, and believe they can teach their entry-level managers the required technical skills considering that each industry has its own technology.

Listed within Table 25 are three courses whose pertinence to their indicated skill areas is not immediately apparent. Fundamentals of Program Development is listed in the area of business and economics. An analysis of the content of this course showed that it provided training in program planning, implementation and evaluation. These skills were presumed to be partly transferrable to similar tasks in business and economics. Research Methodology was identified as providing training in communication on account of its requirements in technical report writing, literature review, data interpretation, and oral presentation. In the third case, Sociology was identified in the area of employment, work and general experiences as it provides general education in the humanities area, a highly regarded AGRI-MASS experience.

College of Agriculture elective courses

The College of Agriculture elective courses are clustered into options designed to provide concentrated study in topics corresponding with the student's career interest. There are a total of nine elective options numbered I - IX: (I) Agricultural Economics (II) Agricultural Education, (III) Agricultural Engineering Technology, (IV) Agronomy, (V) Animal Science, (VI) Extension Education, (VII) Food Processing Technology, (VIII) Horticulture, and (IX) Natural Science. Two options (Table 26) were determined to be applicable to students interested in agribusiness careers.

Table 26

College of Agriculture Agribusiness Elective Options

Elective Options	Credit Units
OPTION I: AGRICULTURAL ECONOMICS	
Agribusiness Analysis and Management	3
Agribusiness Finance and Credit	3
Preparation of Agricultural Projects	3
Co-operatives	2
Entrepreneurship & Human Resource Development	3
OPTION VII: FOOD PROCESSING TECHNOLOGY	
Food and Nutrition	3
Food Microbiology	3
Food Engineering System	3
Food Technology I	3
Food Technology II	3

The academic catalogue of the College of Agriculture provides a synoptic description of each of the courses offered by the College. These were was the best available source of course objectives. The contents of these descriptions were

analyzed to identify curriculum and program activities that were matched by a corresponding AGRI-MASS skill, personal quality or experiences. When this was done, it was found that of 66 AGRI-MASS skills which met the criterion for inclusion in the curriculum, 33 or 50% were identified in the curriculum (Table 27). The data show that the curriculum covers 100% of the 8 AGRI-MASS skills in the technical area meeting the criterion for inclusion in the curriculum. The next most completely covered skill was the area of communication; just under 80% of these skills meeting the criterion to be included in the curriculum were identified in the curriculum. As previously discussed, none of the skills in the area of personal qualities were covered by the curriculum.

Table 27

Number of Specific AGRI-MASS Skills Meeting Criterion for Inclusion in Curriculum and Number Identified in Existing Curriculum[1]

Skill Areas	Number of Skills in AGRI-MASS	Number of Skills in COA Curriculum
A. Business and Economics	20	13
B. Computer, Quantitative and Management Information	4	2
C. Technical	8	8
D. Communication	9	7
E. Personal Qualities	15	none
F. Employment, Work and General Experiences	10	2
Total	66	33

[1]The criterion for inclusion was a score of 4.0 (slightly below average importance) or higher on a scale of 0 = irrelevant to 9 = extremely important

Business and economic skills

There are four COA core courses and fourteen units of elective courses providing training in business and economic skills (Table 25). An analysis of the content description of these courses (see Appendix B) has determined that 13 of the 20 (65%) AGRI-MASS business and economic skills were matched by objectives in the COA counterpart courses (Table 27). Respondents rated each of these skills with importance scores that met the criterion for them to be included in the curriculum.

The other business and economic skills not covered by the curriculum were highly regarded as well, each receiving importance scores above 5.0. Three of these skills (A9, A11 and A12) required students to be instructed in aspects of international business and economics. Jamaica's international trade relations and membership in international economic institutions, and the international ownership and structure of several local agribusiness firms support the need to include topics in international business and economics in the curriculum. Students ought to be provided with an understanding of the functioning of world markets and international trade to take account of their effects on local business. Similarly, the business and economics area should be broadened to take account of such managerial functions as human resource planning and control (A6) and coordination of human and physical resources for efficient operations (A16).

Other skills not covered in the curriculum are professional selling (A3), human resource planning and control (A6), and inventory management (18).

These skills were perceived to be highly important. Inventory management skills should be included in existing accounting courses.

Computer, quantitative and management information

There are twelve credit units of COA instruction designed to provide computer knowledge and quantitative skills (Table 25). As a group, these skills were rated lowest in importance (Table 4). Not only were computer, quantitative and management information perceived by respondents to be of low importance, they were poorly covered by the curriculum. The survey instrument lists a total of ten computer and quantitative skills. In only two of these skills does the curriculum provide training (Table 27). They are the abilities to use business computer software (B1) and interpret and use mathematics and statistical methods (B8). There are only two other skills (B2 and B9) in this category that met the criterion for inclusion in the curriculum.

Considering the pervasiveness of computers in everyday life, the low scores received by computer skills and their low incidence in the curriculum were unexpected. This low priority in both managerial perception and curriculum content may be due to the low usage of microcomputers within the firms and the inability of the college to afford adequate computer equipment and service. Also, if top and middle managers do not use computers in their work, they might not foresee their future use and importance.

Technical skills

In total, 79 credit hours of core courses are provided in the COA curriculum. Thirty-three of these provide technical skills training (Table 25). In addition, technical instruction is offered in five elective courses or 15 credit units (Table 26). This high proportion of technical courses accounts for almost complete coverage of AGRI-MASS survey skills in this category. The only technical skill not covered in the curriculum is computer controlled mechanical processes (C9). With an overall importance score of 3.74, this particular skill did not meet the criterion to be included in the curriculum.

The curriculum review showed that of 8 AGRI-MASS skills meeting the criterion to be included in the curriculum, all were provided by the existing curriculum. The review also showed that the same objectives and thus the same skills were covered in more than one course. Thus, three courses: Crop Production Practices (PLS-320), Soil Management (SLS-312), and Principles of Crop Production (PLS-210), offer instruction in general crop production systems (C2). In another instance, three courses: Food and Nutrition (FPT-311), Food Engineering System (FPT-313), and Food Technology I (FPT-314), duplicate their coverage of food science and processing technology (C6). Technical courses including 33 units of core courses and 12 units of elective courses account for 37% of the total 123 credit units required to complete the COA program of study.

Technical competence is essential. Graduates should be proficient in the technical practices, procedures, processes and skills important in their profession.

It is apparent from the volume of training offered in technical skills that the College has considered these skills to be critical to the curriculum.

Communication skills

The curriculum review identified twelve credit units in four courses providing training in communication skills (Table 25). These courses provide instruction in seven of nine (80%) AGRI-MASS skills in communication (Table 27). The curriculum does not provide formal training to develop creative oral expressions (D5) or listening ability (D7). However, both these skills were perceived to be very highly important for the entry-level manager. While instruction in these two skills was not identified in the formal curriculum, the general catalog of the College lists several extra-curricular activities which are a legitimate source of informal training in both skills. However, the description of extra-curricular activities was not sufficient to permit content analysis for purpose of this study. Students and College of Agriculture staff should be aware of the importance of these skills so they can be deliberately planned and students helped to acquire them in formal and informal ways.

Personal qualities

Appropriate personal qualities were perceived by respondents to be the second most important entry-level requirement for agribusiness managers. Almost all items in the category received importance scores above 6.0. The ability to raise capital for business ventures received a score of 5.57, the only item which received a score lower than 6.0. There are no formal courses in the COA

curriculum specifically identified as providing training in personal qualities. Several skills in the area of personal qualities are in the realm of personal attitudes. Fairnie, Stanton and Dobbin (1989) identified as a source of difficulty building these qualities into the curriculum the belief that attitudes were already formed by the time a student entered tertiary education, accounting for their lack of coverage in the curriculum. On the same issue, Hahn (1986) took the view that it was impossible to separate higher education from these qualities. The curriculum should include objectives and learning experiences designed to reflect such qualities as positive attitudes (E4), moral and ethical standards (E7), self confidence (E7), loyalty (E15), and team skills (E3).

The personal qualities surveyed may be divided into four personal characteristics (E4, E5, E6, and E7) and eleven professional qualities. There are a number of ways in which both sets may be covered in the objectives and learning experiences of students. Most apparent is the improvement in personal qualities engendered through extra-curricular experiences. The College provides a variety of such experiences in both campus and community activities. A further informal source of training in personal qualities is the environment in which staff and students interact, making it possible for students to model appropriate personal skills. in addition, substantive formal activities should be developed and included in the students' curriculum to cover these skills.

Employment, work and general experiences

Table 25 shows that six credit units of co-operative work experience offered by the College of Agriculture are earned through full-time placement in agriculture and agribusiness firms for a period of eight weeks. The purpose of the Cooperative Internship Education Program (CIEP) is to provide a balance between theory and practice, and to reinforce positive work attitudes by introducing students to real-world work experiences. Work study such as that provided by the CIEP is regarded as important by survey respondents (5.61).

Farm work (F1) was perceived to be the second most important experience for the entry-level manager (6.31). Although it is not used in computing credit requirements, an important component of the COA curriculum is its farm practice program (See Appendix B). It accounts for a minimum of 16 hours of farm work in each of four subjects, namely farm mechanics (AET-212), crop production (PLS- 215), livestock production (ANS-112), and horticulture (HOR- 214).

Although all but one type of employment, work and general experiences, were given importance scores above 4.0, it is not surprising that most of them are not provided by the curriculum. Table 27 shows that of ten such experiences, four (20%) were provided by the curriculum. The nature of employment, work and general experiences presupposes that students are placed in medium or long-term employment in or exposure to the situations specified in each experience. This makes it impossible to successfully build most of these experiences into the curriculum. However, students should be aware of their importance.

One AGRI-MASS experience that can be strengthened through a formal curriculum approach is general education in classics, humanities and art (F11). The item received an importance rating of 5.51. A single course in sociology was identified as touching on this experience.

Government/public affairs experience was regarded with rather low importance (3.44) and did not meet the criterion for inclusion in the curriculum.

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Purpose and Objectives

The purpose of the study was to determine the extent to which the curriculum of the College of Agriculture, Jamaica, meets the learning needs of entry-level agribusiness managers based on a comparison with skills perceived to be important to the job.

The specific objectives were to:

1. identify entry-level skills perceived by agribusiness employers to be important for entry-level managers;
2. determine differences in perceived importance of skills by type and size of agribusiness firms;
3. determine the relevance of the curriculum of the College of Agriculture in preparing graduates for entry-level managerial tasks in agribusiness firms.

Procedure

The target population was 122 agribusiness firms listed in the 1991-92 issue of the Jamaica Telephone Directory. Respondents were managing directors, general managers, divisional managers, and one company secretary. They categorized their position as top management (74) and middle management (33). Complete responses were received from 107 firms, a response rate of 88%. With regard to experience, 17.8% of the respondents had fewer than five years

experience in their present position; 46.7% had 5-10 years; 29.9% had 11-15 years; and 5.6% had over 15 years experience. The maximum time worked in the present position by any respondent in the firm was 25 years.

Firms represented in the study are distributed across the country. However, a substantial majority of firms were located in the Kingston Metropolitan Area.

The Agribusiness Management Aptitude and Skill Survey (AGRI-MASS) was the data collection instrument used in the study. Respondents were required to rate the importance of 74 skills in the areas of business and economics; computer, quantitative and management information; technical; communication; personal qualities; and employment, work and general experiences. The instrument used a 10-point Likert-type scale to measure the respondents' perceptions of the importance of each skill for entry-level agribusiness managers. The instrument also solicited information about participating firms and respondents.

Respondents represented four types of firms, namely: marketing, sales, processing, and finance. Three sizes of firms were represented in the study, small, medium and large. Firm type and size were the independent variables in the study. Seventy-four skills grouped into six areas constituted the dependent variables.

The data were analyzed within the framework of General Linear Model (GLM) using the Statistical Analysis System (SAS). The descriptive statistics generated provided data on the relative importance of skills, as least squares

means (LSM), a profile of respondents, and future agribusiness outlook in Jamaica. Tukey pair-wise multiple comparison were used to compare importance scores to identify the existence of statistical significance among firms by type and size. Statistical significance was tested at $\alpha = .05$.

The course descriptions of the College of Agriculture were analyzed, their content tabulated and matched with AGRI-MASS skills. A mean importance score of 4.0 was established as the minimum criterion for a skill to be considered for inclusion in the curriculum.

Findings

Objective 1: Importance of AGRI-MASS skills

1. The order of importance of skill areas was communication; personal qualities; business and economics; technical; employment, work and general experiences; and computer, quantitative and management information. The overall ranking of major skill areas did not change with type or size of firm. With the exception of computer, quantitative and management information, the overall mean importance rating of each skill area was 5.0 (about average importance) or higher. The mean importance of computer, quantitative and management information was less than 3.0, much below average importance. There were four specific skills in the latter skill area which received scores above 4.0, meeting the criterion for inclusion in the curriculum. This criterion was met by 66 (89%) out of 74 AGRI-MASS skills.

2. Within the category of communication, each skill was rated with a mean importance rating above 7.0, above average importance. Writing (8.35) and speaking (8.39) abilities were perceived to be equally high in importance.

3. The area of personal qualities was second in importance to communication skills. Among the top skills in this category were three personal characteristics -- self-motivation, business and work ethics, and positive work attitude. The other items are professional qualities and were all rated between 6 and 7, above average importance.

4. The business and economic skill area was perceived to be of above average importance. The highest ranked skill in this area was the ability to read and use financial statements. The next two most important skills were concerned with micro or firm-level economics.

5. Among technical skills, livestock and crop production were perceived to be the most important requirements for entry-level managers. There was one technical skill in computer controlled-mechanical processes (C9) which did not meet the criterion for inclusion in the general curriculum.

6. Within the area of employment, work and general experiences the most highly rated experiences were previous employment in a Jamaican agribusiness firm (F2) and farm work (F1). The least important was experience in government or public affairs (F6). It was the only experience in the group which did not meet the criterion for inclusion in the curriculum.

Objective 2: Comparison of importance of AGRI-MASS skills by type and size of firm

Respondents perceived significant differences in the importance of a number of skills among different types and sizes of firms.

1. No statistical significance was identified among types of firms for skills in the area of communication. The importance of communicating technical information, both in writing and orally, and the ability to give clear and concise instructions were perceived to be significantly different among firms of different sizes.

2. A comparison of personal qualities showed that the ability to apply technical knowledge in problem-solving situations was perceived to be of significantly greater importance in sales and processing firms than marketing firms. On the other hand, the ability to recognize business opportunity was significantly more important to small firms than medium and large firms.

3. Seven of twenty business and economic skills were significantly different among types of firms, while ten skills were significantly different among firms of different sizes. The direction of these differences did not show a uniform pattern; however, accounting skill was more important to financial firms than the other three types of firms; professional selling was more important to sales firms than to other firms; marketing administration skill was significantly more important to marketing firms; and the ability to read financial statements was more important to financial firms compared to marketing and processing firms, and sales firms compared to marketing firms. In most cases of statistical significance exhibited among firms of different sizes, the skill was more important for small firms.

4. There were significant differences among types of firms in six of eight technical skills while significant differences were identified in three skills among firms of different sizes. A knowledge of food science and processing technology and food transportation and distribution systems were most important to processing firms while a knowledge of soil chemistry and characteristics was most important to sales firms. Three incidences of significance identified among firms of different sizes were in engineering skills. In all three instances the skills were significantly more important to medium and large firms than to small firms.

5. Among employment, work and general experiences, previous work in a financial institution, and the ability to develop a business plan, were significantly more important for financial firms. In contrast, employment experience in non-agricultural business was more important to sales and processing firms than to financial firms. This same experience was statistically more important for small firms than for medium or large firms. Industry internship was significantly more important to small firms compared to medium and large firms.

6. Three of four computer, quantitative and management information skills which met the criterion for inclusion in the curriculum exhibited statistical differences among types of firms. A similar number of these skills showed statistical differences among firms of different sizes. Skill with computer application programs, computerized accounting and quantitative decision-making were of highest importance to financial firms. Computerized accounting, ability to

use and interpret mathematics and statistical methods and quantitative decision-making were most important to medium firms.

Objective 3: Comparison of AGRI-MASS skills with College of Agriculture curriculum

1. The review of the COA curriculum determined that training was offered in 33 AGRI-MASS skills. It was also determined that no skill in the area of personal qualities was provided by curriculum.

2. Sixty-six (89%) of AGRI-MASS skills were rated with importance scores of 4.0 and higher. At this score and above, it was decided that training in a particular skill should be offered in the curriculum.

3. In the area of business and economics, 13 of the 20 skills were specifically covered in the curriculum. Three of the skills not covered related to aspects of international business and economics. The others were training in professional selling; human resource planning and control; and inventory management. They all were perceived to be highly important requirements for the entry-level manager.

4. Courses providing computer, quantitative and management information covered only two of ten specific AGRI-MASS skills. These were the abilities to use general business computer software and to use and interpret mathematics and statistical methods. Their mean importance scores were 5.78 and 4.36, respectively. It also was observed that while respondents regarded the general category of computer, quantitative and management information to be of low importance (2.98), the two specific skills covered in the curriculum as well as the

ability to use computers in quantitative decision making (5.04) were perceived to be highly important and should be offered in the curriculum.

5. There are 33 credit hours of trianing in technical skills offered in ten core courses and 15 units offered in five elective courses. All technical skills meeting the criterion to be included in the curriculum were being offered in the existing curriculum. The curriculum does not provide training in computer controlled production processes (C9) nor did this skill meet the criterion to be included in the curriculum.

6. Two AGRI-MASS skills in communication were not covered in the curriculum. Both skills, expressing creative ideas orally (7.40) and listening and carrying out instructions (7.45), were perceived to be of above average importance and merited a place in the curriculum.

7. No course was identified as providing coverage of specific skill in the area of personal qualities. However, the area was second in importance to communication skills. Each skill in the category was rated above 5.0.

8. A tradition of agricultural training in Jamaica is the on-campus practical experience called farm practice. The College of Agriculture offers farm practice in four course designations: Farm Mechanics (AET 212), Livestock Production (ANS 112), Crop Production (PLS 215), and Horticulture (HOR 214). These courses are not used in the computation of credit requirements, but provide several hours of farm work, a highly regarded experience under the category of employment, work and general experience (5.63). Similarly, the experience in

internship and work study (6.23) offered by the Co-operative Internship Education Program is very highly regarded. Extra curricular experiences were perceived with a mean importance of 5.60 and are offered by the College in several forms.

Conclusions

1. One of the starting points of a curriculum review is for institutions of higher education, in close working relationships with business, to determine the needs of the workplace where graduates are employed. In general, the College of Agriculture has progressed without the benefit of such alliances. As earlier reported, as many as 70% of firms represented in the study did not have formal linkages with educational institutions. This study is an initiative in collaboration between the college and the agribusiness sector of Jamaica's economy. It provides agribusiness the opportunity to influence the training of students to match its needs and the College of Agriculture the prospect of fulfilling its mission to the country's agribusiness sector and students. The process must proceed by treating the unique requirements of agribusiness firms as educational priorities and transforming into specific course units the educational needs which have been identified as important.

2. Communication skills are the most important requirements for entry-level agribusiness managers. This was for all types and sizes of firms. All ten AGRI-MASS communication skills were scored above 4.0 in importance and should be included in training for entry-level managers. Among other sources which have documented the importance of communication skills for technical

trainees, Magill (1982) and Broder and Houston (1986) found that they were at the top of employers' lists of training needs. Agricultural salesmen identified communication to be the second most important skills for new recruits. Personal qualities were identified to be most important (Harris, 1989). Eberle and Beck (1989) in an AGRI-MASS study of agribusiness economics alumni of Southern Illinois University found that communication skills were second in importance to personal qualities of skills required on the job. The latter results are similar to national AGRI-MASS studies conducted in the United States, Canada and Australia (Litzenberg and Schneider, 1987b; Howard, 1989; Fairnie, Stanton and Dobbin, 1989; Howard, et al., 1990;)

The existing curriculum provides 12 credit units of communication skills. These are narrowly focused on writing and rules of grammar. Experience teaches that a large number of students have below-average skills in speaking and writing upon entering college. Koch and Houston (1989) suggest that weak spelling, usage and public speaking skills tend to worsen when not reinforced. They found that learning improved when a great deal of writing is required and that writing improved when students knew their work would be read and judged by people who care about writing. Tudor (1989) suggests that communication is a valuable pedagogy. For these reasons, requiring and reinforcing communication skills in all classes will improve the students' ability to communicate.

Writing-Across-the-Curriculum, based on the concept that all teachers should both require students to use a variety of writing techniques and help teach

writing (Zimmerman, 1991) and Communications and Public Relations in Agriculture (Coorts, 1987) are two program responses that have been used to improve communication skills of agricultural students.

3. The second most important requirement for entry-level managers are appropriate personal qualities. Among these are personal attributes and professional qualities, including leadership and interpersonal skills. These skills have been perceived to be the most important requirement in most other AGRI-MASS studies cited in this study (Howard, et al., 1990; Howard, 1989; Eberle and Beck, 1989; Litzenberg and Schneider, 1989; Fairnie, Stanton and Dobbin, 1989). Personal qualities were not identified with any formal instructional area in the existing College of Agriculture curriculum. Informal extra-curricular experiences and behavior modeling by students within the college are the means by which the college may be offering training in personal qualities. However, such informal approaches are unreliable. This obliges the college to design formal activities within the curriculum to ensure its students' personal competence and preparation for professional interaction.

4. Business and economic skills are the third most important skill area for entry-level managers. There were 20 specific skills in the area, 60% of which were identified in the curriculum. One of the most prominent omissions from this area was instruction in aspects of international business and economics. Global issues are important to agribusiness. Changes in international trade and development, for example, mean that more and more agribusiness graduates will

become involved in some area of the international economy at some point in their careers. Existing course materials may be complemented with an international component or new courses covering topics in international agribusiness issues introduced. These are not mutually exclusive solutions, but the first alternative is the easier to implement. Topics in economics, farm management, marketing, and natural resources can be complemented with a treatment of relevant international issues.

5. Technical skills are the fourth most important skill area. Skills in this area are the most widely covered by the College of Agriculture curriculum. Perhaps, as a result of the large number of interalated technical courses, a duplication of objectives and skills has been identified among technical courses. Of nine specific technical skills, all but one (C9), met the criterion for inclusion in the curriculum.

As a group, technical skills were ranked fourth in similar studies conducted in the United States (Litzenberg and Schneider, 1987b) and Canada (Howard, 1989) and fifth in the Australian study (Fairnie, Stanton and Dobbin, 1989).

6. Employment, work and general experiences are perceived to be less important that technical skills. They were also ranked in a lower position (sixth) in all three AGRI-MASS studies cited. Among the studies cited, as a specific experience in this area, extra-curricular activities was ranked first in the United States and Canadian studies and second in the Australian. They were ranked fourth in the present study.

Eleven experiences are listed in the area, four of which are matched by program activities in the curriculum. Nine out of ten experiences met the criterion to be included in the curriculum. This result indicates that apart from the skills gained through formal courses, students can improve their marketability by the practical experiences obtainable in previous work. In most cases, students will not have had many opportunities to gain such experiences. However, active roles in extra-curricular activities and experiences gained through cooperative internship are choices which the student might make to compensate for lack of work experience. Similarly, traditional classroom approaches do not have the scope to provide the skills required to perform several important managerial duties. Management of technical, economic and human resources are examples. Field trips, case studies, guest presentations are some of the teaching techniques that may enhance the acquisition of these skills.

7. The skill area least important to the agribusiness industry is computer, quantitative and management information. Of 10 specific skills in the area, four met the criterion to be included in the curriculum and only two skills were actually covered in the curriculum. In the other AGRI-MASS studies cited, computer skills were ranked fourth in Australia (Fairnie, Stanton and Dobbin, 1989) and fifth in the United States (Litzenberg and Schneider, 1987b) and Canada (Howard, 1989). In the present study, although not in the same order, the four skills that met the criterion to be included in the curriculum were the most highly ranked in the United States, Australia and Canada.

8. The overall ranking of the six AGRI-MASS skill areas were the same when type or size of firms was considered. However, of the 66 specific skills which met the criterion to be included in the COA curriculum, 22 were significantly different by type of firm; 21 were significantly different by size of firm. These differences were greatest for business and economic skills among firms of different types and sizes, and for technical skills among firms of different types. The differences were least for communication skills and personal qualities. Custom designed in-service training programs have been suggested by Moser (1985)) as one means of responding to differences in educational needs by industry segments. An alternative response advocated by Litzenberg and Schneider (1987b) is to target the curriculum to the needs of those segments of the agribusiness industry where future opportunities for employment may be greatest.

Recommendations for Curriculum Design

The purpose of this study was to facilitate curriculum review and improvement. It started out to determine the job requirements of graduates as perceived by prospective employers. The process should proceed by incorporating into the curriculum, objectives to meet the skills identified in the study to be important. Ultimately, learning experiences should be designed to meet these objectives.

A formal course in personal qualities

The college has depended on informal approaches in its coverage of training in personal qualities. However, changes in personal qualities are not easy to

achieve and are not easily incorporated through existing courses. The voluntary nature of the present approaches, it has been argued, is inadequate and unreliable and cannot assure consistent outcomes. It is recommended that a specific course of study which models appropriate personal qualities and provides opportunities for students to understand and practice these qualities be added to he curriculum.

A model of such a course is an upper level, three-credit course offered for the past several years at Washington State University in the United States. The content of the course is broadly termed; "leadership skills", and was designed to build non-technical skills, knowledge and perspectives for students to be better professionals, better citizens and better leaders. The course is based on eight leadership principles and the development of a corresponding teaching/learning climate which (1) encourages students to become more independent and self-directed in their learning, (2) allows students to learn form experience by decreasing content transfer in favor of experiential learning, (3) promotes information gathering and communication skills, (4) raises self-esteem by promoting learning in the affective domain as well as the cognitive domain, and (5) helps students apply technical expertise within a broad context by encouraging them to explore broad perspectives over narrow disciplinary views. In addition, specific approaches are used to help students understand and reflect on (6) alternative world views, (7) learning and leadership styles, by adapting teaching and learning styles rather than forcing students to the instructor's, and (8) group

dynamics, by promoting the use and understanding of group learning in addition to individual learning modes.

Specific teaching/learning approaches have been tried and suggested to promote the teaching/learning climate and leadership principles discussed. They include learning contracts, learning logs, world views analysis, leadership and learning style inventories, team projects, peer teaching, and role models (Jimmerson, 1991).

Informal curriculum approaches

Existing informal learning approaches should be continued and others incorporated in existing disciplinary courses. For these approaches to be effective, college administration and faculty should be deliberate in promoting their application. Self-motivation, positive work attitude and ethical attitudes can be fostered and reinforced in students by informal means, but for the process to be successful, the faculty team must demonstrate the same qualities in their corporate behavior. Students should be able to positively identify these same attributes in all the courses, subjects or units in which they are enrolled. Case studies which highlight difficult ethical issues and choices might assist students to make better decisions in the workplace, but these discussions are better held across the curriculum. Listening skills can be developed by using written instructions less often. Also, students can be required to summarize orally key aspects of industry visits.

Communication across the curriculum

Communication skills were rated highest by respondents in firms of all types and sizes. Therefore, the employability of students can be enhanced by increasing their ability in these skills. It is recommended that, in addition to specific courses, communication skills be incorporated in all subjects across the curriculum. Koch and Houston (1989) suggest a strategy that is useful to the animal and plant science teacher and the agricultural economics teacher alike. They call for (1) identifying topics in each course where students can use speaking and writing skills, (2) constructing oral and written experiences which relate course topics to the student's technical field, (3) building credit into the grading system to emphasize the importance of speaking and writing, and (4) setting high standards for output.

Business and economic skills

Under the area of business and economics, material presented in courses in marketing, economics, and farm management should be broadened to include topics in related international issues. Market risks that local agribusinesses face are increasingly affected by foreign products and consumers, especially with the evolution of Government of Jamaica free-market economic policy. Marketing courses should include discussions on trade flows, tariff and non-tariff barriers to trade, marketing systems and international institutions. Given that most agribusiness products produced or consumed in Jamaica are traded

internationally, students should be exposed to the international dimensions of agribusiness by tracing the market systems for local agribusiness products.

Technical skills

The curriculum area that might be reduced for students going into agribusiness to add new courses or units is that of technical skills. At present, these course account for a very high proportion of the curriculum.

Recommendations for Further Research

What are the employment opportunities?

Additional research should be done to find out the number of agribusiness jobs where future opportunities for employment may exist. The specificity of many of the skills by type and size of firm supports the need to identify the specific quantitative needs of each sector. In addition to the information such research will generate, it is one more activity which will improve collaboration between agribusiness and the College of Agriculture.

How applicable are technical skills?

It is recommended that research be done to find out how much training in specific technical skills is required by graduates. Technical courses dominate the present curriculum. The delivery of this high proportion of technical information preserves part of a local tradition of attempting to provide each agricultural graduate with thorough knowledge of all aspects of the field. Considering the constant and rapid pace of technological and information change and job requirements, as a result, it may be difficult for each student to attain depth in

every technical area. The intent of the research being recommended is to find out the on-the-job relevance of specific curriculum based technical information.

How has the college performed?

Research should be done to determine how well the College of Agriculture has prepared graduates to meet modern job demands and the graduate's own satisfaction. Alumni follow-up studies are recommended as an effective way to evaluate the curriculum, identify the nature of employment for which students have been prepared, and gather information on how successful the program has been in preparing them for job entry and advancement.

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APPENDIX A
AGRIBUSINESS MANAGMENT APTITUDE AND SKILL SURVEY
(AGRI-MASS)

Please use the scale below (0-9) to show the relative importance of skills required by entry-level managers in your firm. Circle the number that corresponds to your view of the item's relative importance. Circle N/A if you have no opinion or no basis for rating a particular item.

0 irrelevant	1 very slightly important	2 much below average
3 below average	4 slightly below average	5 about average
6 just above avge	7 above average	8 much above average
9 extremely important		

A. BUSINESS and ECONOMIC SKILLS

1.	A1	Ability to read, understand and use financial statement	0 1 2 3 4 5 6 7 8 9 N/A
2.	A2	Understanding of accounting concepts and procedures	0 1 2 3 4 5 6 7 8 9 N/A
3.	A3	Ability to understand and use professional selling techniques	0 1 2 3 4 5 6 7 8 9 N/A
4.	A4	Understand marketing administration (systems, strategies, organization, structure, management)	0 1 2 3 4 5 6 7 8 9 N/A
5.	A5	Understanding of corporate finance (capital structure, formation, and budgeting)	0 1 2 3 4 5 6 7 8 9 N/A
6.	A6	Understanding of human resource planning and control	0 1 2 3 4 5 6 7 8 9 N/A
7.	A7	Understanding firm/industry (micro) economics (supply, demand, and price determination)	0 1 2 3 4 5 6 7 8 9 N/A
8.	A8	Understanding of domestic (Jamaica) macro economics (supply, demand, and price determination)	0 1 2 3 4 5 6 7 8 9 N/A

9.	A9	Understanding of international macro economics (exchange rates, etc.)	0	1	2	3	4	5	6	7	8	9	N/A
10.	A10	Understanding of current and historic Jamaican agricultural policy	0	1	2	3	4	5	6	7	8	9	N/A
11.	A11	Understanding of current and historic international trade and export policy and procedures	0	1	2	3	4	5	6	7	8	9	N/A
12.	A12	Understanding of the effects of national and international political and economic forces on business operations	0	1	2	3	4	5	6	7	8	9	N/A
13.	A13	Ability to identify realistic objectives and goals for the agribusiness firm	0	1	2	3	4	5	6	7	8	9	N/A
14.	A14	Ability to develop business policies and programs for the agribusiness firm	0	1	2	3	4	5	6	7	8	9	N/A
15.	A15	Ability to identify, monitor and evaluate key areas and progress toward the objectives and goals of the firm	0	1	2	3	4	5	6	7	8	9	N/A
16.	A16	Ability to coordinate human and physical resources for efficient operations	0	1	2	3	4	5	6	7	8	9	N/A
17.	A17	Knowledge of process and product layout and design	0	1	2	3	4	5	6	7	8	9	N/A
18.	A18	Familiarity with inventory management Systems	0	1	2	3	4	5	6	7	8	9	N/A
19.	A19	Understanding of alternative types of business organizational structure	0	1	2	3	4	5	6	7	8	9	N/A

20.	A20	Ability to identify and manage risk and uncertainty	0 1 2 3 4 5 6 7 8 9 N/A
B.		COMPUTER, QUANTITATIVE AND MANAGEMENT INFORMATION SKILLS	
21.	B1	Use general business computer software (spread sheets, data bases, word processing)	0 1 2 3 4 5 6 7 8 9 N/A
22.	B2	Understand/use computerized accounting systems.	0 1 2 3 4 5 6 7 8 9 N/A
23.	B3	Write specifications for hardware & and software	0 1 2 3 4 5 6 7 8 9 N/A
24.	B4	Communicate with programmers	0 1 2 3 4 5 6 7 8 9 N/A
25.	B5	Write computer programs	0 1 2 3 4 5 6 7 8 9 N/A
26.	B6	Supervise computer personnel	0 1 2 3 4 5 6 7 8 9 N/A
27.	B7	Understand & use local area network (LAN)	0 1 2 3 4 5 6 7 8 9 N/A
28.	B8	Use and interpret math and statistical methods	0 1 2 3 4 5 6 7 8 9 N/A
29.	B9	Use computers in quantitative managerial decision-making	0 1 2 3 4 5 6 7 8 9 N/A
30.	B10	Perform telecommunication functions	0 1 2 3 4 5 6 7 8 9 N/A
C.		TECHNICAL SKILLS	
31.	C1	Understanding general livestock/ meat production systems	0 1 2 3 4 5 6 7 8 9 N/A
32.	C2	Understanding general crop production systems	0 1 2 3 4 5 6 7 8 9 N/A
33.	C3	Understanding specialized crop production systems (fruits,	

		vegetables, nuts, citrus, etc.)	0 1 2 3 4 5 6 7 8 9 N/A
34.	C4	Understanding soil chemistry and characteristics	0 1 2 3 4 5 6 7 8 9 N/A
35.	C5	Understand bioscience, biotechnology and biochemistry	0 1 2 3 4 5 6 7 8 9 N/A
36.	C6	Understanding food science and processing technology	0 1 2 3 4 5 6 7 8 9 N/A
37.	C7	Understand food transportation and distribution systems	0 1 2 3 4 5 6 7 8 9 N/A
38.	C8	Understand engineering technology of production/processing machinery	0 1 2 3 4 5 6 7 8 9 N/A
39.	C9	Understand computer controlled mechanical processes	0 1 2 3 4 5 6 7 8 9 N/A
D.		COMMUNICATION SKILLS	
40.	D1	Ability to write technical reports, memos, and letters	0 1 2 3 4 5 6 7 8 9 N/A
41.	D2	Ability to speak clearly & concisely on technical information	0 1 2 3 4 5 6 7 8 9 N/A
42.	D3	Ability to give clear and concise instructions to others	0 1 2 3 4 5 6 7 8 9 N/A
43.	D4	Ability to express creative ideas in writing	0 1 2 3 4 5 6 7 8 9 N/A
44.	D5	Ability to express creative ideas orally	0 1 2 3 4 5 6 7 8 9 N/A
45.	D6	Ability to read and understand specific technical information	0 1 2 3 4 5 6 7 8 9 N/A
46.	D7	Ability to listen to and carry out instructions	0 1 2 3 4 5 6 7 8 9 N/A

47.	D8	Ability to listen to & summarize lengthy oral presentations	0	1	2	3	4	5	6	7	8	9	N/A
48.	D9	Prepare & deliver oral presentations	0	1	2	3	4	5	6	7	8	9	N/A

Use the following scale to show the relative importance of the personal qualities for entry-level managers in your firm. Circle the number that corresponds to your view of the item's relative importance. Circle N/A if you have no basis for rating a particular item.

0 irrelevant	1 very slightly important	2 much below average
3 below average	4 slightly below average	5 about average
6 just above avge	7 above average	8 much above average
9 extremely important		

E. PERSONAL QUALITIES

49.	E1	Ability to provide leadership and make decisions	0 1 2 3 4 5 6 7 8 9 N/A
50.	E2	Ability to manage people and delegate responsibility and authority	0 1 2 3 4 5 6 7 8 9 N/A
51.	E3	Ability to work with others and be a team player in problem solving	0 1 2 3 4 5 6 7 8 9 N/A
52.	E4	Positive work attitude/personality/ability to work hard	0 1 2 3 4 5 6 7 8 9 N/A
53	E5	Self-motivation	0 1 2 3 4 5 6 7 8 9 N/A
54.	E6	Self-confidence and ability to "take a chance" and handle stress/failure/rejection	0 1 2 3 4 5 6 7 8 9 N/A
55.	E7	Business and work ethics	0 1 2 3 4 5 6 7 8 9 N/A
56.	E8	Ability to work under varied conditions	0 1 2 3 4 5 6 7 8 9 N/A
57.	E9	Ability to recognize a business opportunity	0 1 2 3 4 5 6 7 8 9 N/A
58.	E10	Ability to select and supervise other employees	0 1 2 3 4 5 6 7 8 9 N/A

59.	E11	Ability to apply technical skills and information in problem solving situations	0	1	2	3	4	5	6	7	8	9 N/A
60.	E12	Ability to take a position and defend it, sell your ideas	0	1	2	3	4	5	6	7	8	9 N/A
61.	E13	Ability to work without supervision	0	1	2	3	4	5	6	7	8	9 N/A
62.	E14	Ability to raise capital for new and ongoing business ventures.	0	1	2	3	4	5	6	7	8	9 N/A
63.	E15	Loyalty to the organization	0	1	2	3	4	5	6	7	8	9 N/A

Use the following scale to show the relative importance of the personal experiences for employees in your firm. Circle the number that corresponds to your view of the item's relative importance. Circle N/A if you have no opinion or basis for rating a particular item.

0 irrelevant 1 very slightly important 2 much below average
3 below average 4 slightly below average 5 about average
6 just above avge 7 above average 8 much above average
9 extremely important

F. EMPLOYMENT, WORK and GENERAL EXPERIENCES

64.	F1	Farm work	0 1 2 3 4 5 6 7 8 9 N/A
65.	F2	Employment in domestic (Jamaican) agribusiness firm	0 1 2 3 4 5 6 7 8 9 N/A
66.	F3	Employment in financial institution	0 1 2 3 4 5 6 7 8 9 N/A
67.	F4	Employment in non-agricultural retail business	0 1 2 3 4 5 6 7 8 9 N/A
68.	F5	Employment in international agribusiness form	0 1 2 3 4 5 6 7 8 9 N/A
69.	F6	Government/public affairs	0 1 2 3 4 5 6 7 8 9 N/A
70.	F7	Industry internships/cooperative work-study experiences	0 1 2 3 4 5 6 7 8 9 N/A
71.	F8	Personnel training functions	0 1 2 3 4 5 6 7 8 9 N/A
72.	F9	Developing business plan organizing business project	0 1 2 3 4 5 6 7 8 9 N/A
73.	F10	Extra curricular activities in college	0 1 2 3 4 5 6 7 8 9 N/A
74.	F11	General education in the classics/humanities/arts, etc.	0 1 2 3 4 5 6 7 8 9 N/A

G. Thank you for rating these skills and experiences needed by entry-level agribusiness managers. Please provide us with the following additional information for your firm.

75. G1 What is the title of your position? _____

76. G2 Would you describe your position as (check the best answer)

o Junior Level o Middle Management o Top Management

77. G3 How long in this position? (number of years) _____

78. G4 How would you describe the major activity of your business establishment?

o Produce Marketing
o Agricultural Supply Sales
o Meat, Dairy, and Food Processing
o Grain Processing and Distribution
o Other
(Specify) _____

79. G5 What is the approximate average number of employees in your firm (during the last twelve months)?

o 1 - 9 o 40 - 59 o 100 - 199
o 10 - 39 o 60 - 99 o 200 or more

80. Do you maintain links with any educational institution because of the training needs of your firm? o Yes o No

81. G6 Of candidates with the following educational qualifications, which do you prefer to hire for entry-level management positions in the firm? Check only one response.

o grammar high school diploma
o technical high school diploma
o vocational agricultural school diploma
o College of Agriculture degree

o College of Art Science and Technology degree
If yes, in what discipline? _____

O University degree
If yes, in what discipline? _____

82. G7 How would you rate graduates of the College of Agriculture (COA) as a result of their preparation in relation to other employees who have not received similar training?

O no basis for opinion
O COA graduate is better prepared
O both are about the same
O COA graduate is less well prepared

83. How well do you think the COA prepares students for employment in specific industries such as agribusiness?

84. G8 What, in your opinion, are present job opportunities and the future outlook for entry-level management positions in agribusiness?

Present	Future
O very good	O very good
O good	O good
O uncertain	O uncertain
O poor	O poor
O very poor	O very poor

APPENDIX B
ASSOCIATE DEGREE IN SCIENCE PROGRAM

Curriculum Features and Objectives

The College of Agriculture is designed for full time study to prepare students for careers in agriculture and allied industries. The primary features of the curriculum are:

1. The provision of a three year period of study leading to the Associate Degree in Science in Agriculture, A. Sc. (Agriculture).

2. Each academic year is comprised of two semesters of sixteen weeks each.

3. A total of 36 classroom courses, a minimum of 1485 hours of farm practical, and 320 hours of off-campus work experience, for a total of 119-129 credit units must be completed to earn the degree.

4. The provision of broad-based education program, including the natural sciences and humanities.

5. The provision of study in the applied agricultural sciences including animal science; plant and soil science; farm management and marketing; agricultural engineering technology.

6. The provision of work experience for students in primary agricultural production and in agro-industries through farm practice and the Co-operative Internship Educational Program (CIEP).

7. The provision of a balance between theory and practice to prepare individual for middle-level careers in agriculture and related fields.

8. the development of positive work attitudes toward agriculture through farm practice, work study and CIEP.

Curriculum Objectives

The objectives of the curriculum are:

1. To enable students to acquire the knowledge and skills necessary to become successful entrepreneurs in agriculture.

2. To train farmers to adopt and practice modern agriculture.

3. to prepare agricultural technologists to work effectively with communities in agricultural production, marketing and agro-industries.

4. To produce extension agents for rural development with insight into rural social systems and necessary skills in communication and diffusion of agricultural technology.

5. To prepare teachers of agriculture to undertake the training of children and youth to participate in agricultural production and development.

Program Profile

The College of Agriculture offers a general agricultural program covering subjects in Agricultural Economics, Agricultural Education, Agricultural Engineering Technology, Computer Science, Plant and Soil Science, Animal Science, and Food Technology and Consumer Science, During the third year of the curriculum, students are allowed to take elective courses, for the purpose of developing concentrated competencies in their career interests. The elective options are:

1. Agricultural Economics
2 Agricultural Education
3. Extension Education
4. Agricultural Engineering Technology
5. Agronomy
6. Animal Science
7. Horticulture
8. Food Processing Technology

Course Description by Department (DANS)

Department of Animal Science

ANS 112 - Farm Practice: Livestock Production

This course in the laboratory for AND 210 and 320, and is intended to provide students with the opportunity to develop competence, knowledge and attitudes which wold enable them to apply theory to practice; to develop wise use of management of time and the factors of production; to produce a well rounded graduate who can contribute significantly to the development of agriculture

The course covers production practices of poultry, beef, dairy, swine, fish, goat, sheep, and other small stock; slaughtering and fabrication of carcasses.

The duration of the course in 15 weeks; instruction is given for 16 hours per week; evaluation is on a pass/fail basis.

ANS 210: Principle of Livestock Production (3 credit units; 3-0)

The course s intended to provide guidelines for decision making pertinent to selection, feeding, breeding and general management of farm animals, in order to produce marketable farm products.

Pre-requisite: BIO 111, ZOL 112

ANS 313: Animal Nutrition (3 credit units; 2-2)

This course is intended to integrate the basic concepts concerning the nature of nutrition, embracing in some details, the classification and measurement of feed nutrients, and comparison of schemes for describing the nutrients; a study of the digestion, absorption and metabolism of nutrient, through intermediary metabolism of carbohydrates, protein and fats. It embraces studies of mineral elements, vitamins, water, and effects of water restriction on farm animal; an elementary study only of some aspects of rumen microbial synthesis of nutrients.

Pre-requisites: ZOL 112, ZOL 213, CHE 213

ANS 314: Veterinary Science (4 credit units; 3-2)

This course highlights the major diseases and disorders un farm animals and their causes. Disease prevention and control; factors affecting the health of farm

animal. Anima health programs in Jamaica. Drugs and vaccines, their uses and abuses.

Pre-requisites: AND 210, BIO 111, ZOL 213.

ANS 315: Pasture Management (3 credit units; 3-0)

A study of the principles of pasture establishment including collecting and handling of seed and vegetative planting material; selection of site, location of pastures, land preparation and planting methods. A study of grassland management for pastures including mowing, fertilizing, weed control and rotational grazing. Principles of pasture evaluation including, green forage per acre, dry matter per acre, total digestible energy, gross energy, net energy and live weight gain per acre. Carrying capacity and a brief study of the principles of hay and silage production applicable in Jamaica.

Pre-requisite: SLS 211, PLS 210, AND 210

ANS 316: Fisheries (3 credit units; 3-0)

A study of the major groups of fish, the principles of fish production, the environment for fish, fishery surveys, principles of fishery development and management, and marketing of fish.

Pre-requisite: AND 210

ENT 316: Apiculture (3 credit units; 2-2)

This course focusses on types of bees and beehives, climate and beekeeping; life cycle of the honey bee the castes, resource needs of the colony; management considerations in beekeeping; beekeeping materials and equipment; extraction, grading and storage of honey.

Pre-requisite: BIO 111

ANS 317: Animal Breeding (3 credit units; 2-2)

This course is intended to establish and appreciation of the role of animal breeding in livestock production; to give the student a foundation knowledge of animal breeding and introduce the basic concepts and principles involved in the improvement of livestock through the use of animal breeding methods.

Pre-requisite: AND 210, ZOL 112, ZOL 213

ANS 318: Meat Cutting and Packaging (2 credit units; 1-2)

This course is intended to provide students with theoretical and practical exposure and experience in slaughtering, abattoir management and the cutting, preservation and storage of meets.

Pre-requisite: BIO 11, ZOL 112

ANS 319: Livestock Production Practicum

This course is essentially practice for students preparing for careers in livestock production. the students get an opportunity, through projects and lecture demonstrations, to widen their skills base and competencies, and be more fully conversant in the management of beef, dairy, poultry, swine, goat, sheep and other livestock species.

The duration of the course is 15 week; instruction is given for 16 hours per week, evaluation is on a pass/fail basis.

Pre-requisite: AND 112

ANS 321: Small Stock (2 credit units 2-0)

This course includes a review of breed characteristics,, distribution, environmental requirements, marketing, and management of the production of goats, sheep, rabbits and other small stock

Pre-requisite: AND 210

Department of Humanities, Social Sciences and Education (DHSSE)

AEC 211: Fundamental of Agricultural Economics (3 credit units; 3-0)

Introduction to micro and macro economics; demand, supply, supply, and market price; market structure; the conditions of competition; production economics; theory of the firm; factors of production and the rewards; theory of distribution; the flow of income; agricultural price policy.

AEC 212: Farm Business Management (4 credit units; 3-2)

organization of Jamaica agriculture; classification of farms; distribution of farmlands; types of farming and patterns of production; production function - law of diminishing returns; land tenure and land fragmentation; factors affecting farm organization and operation; problems of labor and marketing; analysis of the farm

as a business - measures of profit and se of efficiency factors; operating a farm business, choice, organization, insurance, income tax; elements of book-keeping; use of the ledger and subsidiary book; the cash analysis system; records and accounts in the farm business.

Pre-requisites: AEC 211

AES 313: Agribusiness Analysis and Management (3 credit units; 3-0)

Methods of agricultural planning, programming and analysis. Accounting and business management as they relate to agriculture and agro-industries. Entrepreneurship in agribusiness.

pre-requisite: AEC 211, AEC 212

AEC 314: Agricultural Marketing (3 credit units; 3-0)

The economic principles of marketing agricultural products, marketing systems, marketing function, structure, conduct, and performance of agricultural product and input market, concepts and frameworks for the analysis of firms in perfect and imperfect markets; and application of economic principles to international markets for food products.

Pre-requisites: AEC 211, AEC 212

AEC 315: Finance and Credit (3 credit units; 3-0)

This course is designed to examine the legal status, finance, marketing systems, management tools of financial institution. Emphasis on firm level decisions to include firm growth, leverage, liquidity, capital rationing, budgeting and sources of credit.

Pre-requisite: AEC 211, AEC 212

AEC 316: Preparation of Agricultural Projects (3 credit hours; 3-0)

Conceptual consideration of the role of agriculture in economic development; characteristics of developing nations, essentials for achieving growth with development, and theoretical policy implications relevant to the development process in low income countries. Special consideration to the design,

implementation, and evaluation of agricultural and rural development projects. Emphasis in on establishment and application of criteria to decide on investment in alternative projects.

Pre-requisite: AEC 211, AEC 212

AEC 317: Agricultural Cooperative (2 credit units; 2-0)

This course analyses the history, purpose, organization, mode of operation, management, financing, legal status and marketing systems of agricultural cooperatives

It focuses primarily on farmers cooperatives, community based cooperatives, financial cooperatives and marketing cooperatives.

Pre-requisites: AEC 211

AEC 318: Entrepreneurship & Human Resource Development

This course is designed to provide students with the necessary skills to initiate a business, and also to manage the financial and human resource component of the enterprise. It is divided into two part. Part 1 deals with concepts of entrepreneurship, feasibility studies and preparation of project plan; basic accounting principles; fundamentals of business operations; fundamental of capital budgeting and management of working capital. Part 2 deals with human resource management. Topics covered include structure of the organization; personnel management, time management; leadership; nutrition, and communication.

Pre-requisite: AEC 211

AED 312: Teaching in Agriculture (3 credit units; 3-0)

Foundations fore methods in agricultural education including techniques and strategies for teaching topics in agriculture; lesson planning and presentation of lessons; selection and use of auditory-visual materials; management of classroom and laboratory; practice in micro teaching.

Pre-requisite: EDF 111

AED 313 (316): Testing and Measurement (3 credit units; 3-0)

This course is intended to enable teachers in training to acquire the knowledge of the principles skills and attitudes necessary to undertake property testing and measurement of instruction. The course is designed to provide a

systematic approach to evaluate students; performance and achievement. It covers concepts of testing, measurement and evaluation; types of tests; test construction; test measurement and evaluation; statistical concepts and consideration.

Pre-requisite: EDF 111, EDF 213, AED 312

AED 314: Leadership Development (3 credit units; 3-0)

Principles and practice of leadership development in youth organizations. Organization and operation of 4-H clubs in Jamaica; planning and conducting programs of activities for youth organizations; identifying, organizing and operating supervised project for the purpose of developing both agricultural and leadership skill in youth.

Pre-requisite: EDF 111, EDF 213

AED 315: Instructional Technology (3 credit units; 2-3)

This course is particularly for students who intend to become teachers of agriculture, but is open to potential extension officers and others interested clients. It aim to provide an exposure, and to develop a significant level of competence in the identification, development and use of instructional aids to improve the quality of instruction. The topics to be studied include history and importance of instructional technology; types of instructional aids; use of instructional aids; innovative ideas in teaching; transportation of teaching ideas to instructional devices; the importance and use of indigenous materials in the development of audio and visual aids.

Pre-requisite: EDF 111, EDF 213, AED 312

AED 316: Teaching Internship (6 credit units; 0-40)

Practice teaching under the supervision of a teacher of agriculture in an approved all-age or secondary school for a period of twelve weeks.

Pre-requisite: EDF 111, EDF 213, AED 312, AED 313

EED 312: Principles and Practices of Extension (3 credit units; 3-0)

Principles underlying extension education; application of learning and teaching concepts in extension education; techniques and practices employed by extension workers to deliver improved agricultural practices to rural areas.

Pre-requisite: EDF 111, EDF 213

EED 313: Extension Communication (3 credit units; 3-0)

Application of principles and concepts of communication in the extension education program; delivery systems and techniques employed to transmit agricultural information from its source to the agricultural community.

Pre-requisite: EDF 111, EED 312

EED 314: Comparative Extension Systems (3 credit units; 3-0)

Structure and organization of extension education in Jamaica and other selected countries; comparative analysis of extension systems used throughout the world including factors affecting programs and organizations within these systems.

Pre-requisite: EDF 111, EDF 213, EED 312

EED 315: Extension Program Evaluation (3 credit units; 3-0)

Synthesis and integration of relevant concepts, principles and theories of evaluation and their application to programs in extension education;

Pre-requisite: EDF 111, EDF 213, EED 312

EED 316: Program management in Extension (3 credit units; 3-0)

Application of relevant concepts and principles from management and supervision theory and from leadership and organization to the implementation of extension eduction programs

Pre-requisite: EDF 111, EDF 213, EED 312

EED 317: Extension internship (3 credit units; 0-40)

The internship includes eight weeks of study, observation and practice in extension work. It is conducted in a rural community under the supervision of College of Agriculture faculty, and a Ministry of Agriculture extension office.

Pre-requisite: EDF 213, EDF 213, EED 312

EDF 111: Foundations of Education (3 credit units; 3-0)

This course is intended to allow students to identify, examine and understand the bases of education, and how theses apply to modern forms and structure of education. To foster the development of an awareness and appreciation for the development of science and all forms of study, thus providing a background for the study of other subjects.

The course covers the philosophical, psychological and sociological bases of education, economical and political considerations; and the implications of these in the development and history of education.

EDF 213: Fundamentals of Program Development (3 credit units; 3-0)

The course is designed to assist students with the application of relevant concepts and principles from change theory, educational philosophy, communication theory, planning, implementation, and evaluation to the problems of developing viable education and training programs.

Pre-requisite: EDF 111

ENG 111 (112): Use of English (3 credit units; 3-0

This course is designed to assist students in coping with each college course through the understanding and practice of english. It seeks to develop the student's competence in writing, technical and general information through emphasis on logical sequencing and general expression in standard english.

ENG 213 (211): Communication Skills (3 credit units; 3-0)

The course is designed to develop language skills appropriate for persuasion and interpersonal communication at the workplace, and in the society at large. It focuses on technical and report writing; public speaking; business correspondence; general information transfer; counselling and general demeanor.

Pre-requisite: ENG 111

SOC 211 (311): Sociology (3 credit units 3-0)

This course is designed to give students an understanding of social dynamics influencing community and national life.. It covers nature and scope of society; concepts of society community, group and association. culture; social stratification, social institutions; social change; and the relevance of sociology to agricultural development.

SOC 312: Rural development (3 credit units; 3-0)

This course is designed to expose students to an approach to rural development. It focuses on trends of change in family structure, values, beliefs and economic power structure; migration and mobility; urbanization; modernization; educational advancement; land reform; mechanized farming, cooperatives and the role of voluntary agencies in community development. Socio-economic effects of planned change reflected as gain. disparities. constraints and social stratification with special reference to small farmers and landless laborers.

Pre-requisite: SOC 211

Department of Natural Science

BIO 111: Biology (4 credit units; 3-2)

Morphology, anatomy, and basic information in the physiology of plants; morphology and anatomy of roots, stems. leaves, flowers, fruits; pollination and fertilization; from and fertilization ecology: biotic plant environment relationships, vegetation of Jamaica; development of male and female gametophyte, seed formation; and outlines of plant geography.

Theories of the origin of animal life, morphology and anatomy of various animal groups; social and economic importance of animals; ecology; plant-animal and environmental relationships; basic information in animal physiology, introduction to parasitology and entomology; marine and fresh water biology.

BIO 212: Microbiology (4 credit units; 3-2)

This course is intended to integrate basic concepts and techniques in microbial studies. Topics will include microbial classification, isolation, cultivation and identification of microbes of special importance in veterinary pathology as well as food and industrial microbiology.

This course will also offer introductory information dealing with the morphology, taxonomy, ecology and physiology of selected members of the fungi kingdom, with special emphasis on important plant parasite.

Pre-requisite: BIO 111, BOT 112, ZOL 112

BIO 214: Genetics & Breeding (4 credit units; 3-2))

The course is designed to increase students' awareness of the role genetics and breeding play in animal and crop production. It covers concepts, nature and functions of cells, chromosomes and genes; inheritance; sex determination and linkage; fundamental principles of population specific characteristics, products and processes.

Pre-requisites: BIO 111, BOT 112, ZOL 112

BOT 112: Botany - Plant Taxonomy (3 credit units; 2-2)

This course in designed to teach the principles and concepts underlying plant nomenclature and classification; and to compare the various systems of plant classification. It includes topics relating to the five kingdom system of classification; important features of bryophytes, thallophytes, gymnosperms and angiosperms systems of plant and crop classification; and the characteristic features of the main families of plants used in commercial agriculture.

Pre-requIsite: BIO 111
BIO 213: Plant Physiology (4 credit units; 2-3)

This course is intended to help students develop and understanding of fundamental physiological concepts and principles of green plants through a study of the relevant theories and practices. The course covers: transport in plants, mineral nutrition, photosynthesis, enzymes, respiration, nitrogen, metabolism, growth and development, plant hormones and growth regulators, synergism and antagonism, phytochrome and effects of light on plant development, vernalization and flowering, plant movements, dormancy and germination and the role of plant physiology in agriculture.

Pre-requisite: BIO 111, BOT 112

BIO 315; Biotechnology (3 credit units; 2-3)

This is an elective course to be taken by students who are interested in widening their understanding in the study of pant science. The course aims to provide an exposure to the study of histology and cytology; the propagation of

plants through the manipulation of plant parts using tissue culture techniques; the care and adoption of plantlets for establishment in the natural environment.

Pre-requisite: BIO 111, BIO 112, BIO 213

CHE 111 (112): Inorganic Chemistry 1 (4 credit units; 3-2)

This is a first course in college chemistry which is intended to provide students with the background in chemistry essential for proper understanding of plant and animal function, soil chemistry, fertilizers and their uses, pesticides, herbicides and medicines.

The topics to be studied include: atomic structure and bonding; nuclear structure and radio-chemistry; quantitative and qualitative chemistry; physical characteristics of chemical reactions; the periodic table; applications of general and inorganic chemistry in agriculture, archeology, anthropology, environmental engineering, industry, housekeeping and medicines.

CHE 213: Organic Chemistry 3 credit units; 2-2)

Introduction to chemistry of carbon compounds, analysis of organic compounds, nomenclature of organic compounds, homologous series. isomeric structure and bonding; functional groups and chemical reactions of organic compounds, stereochemistry and reactivity in organic chemistry in agriculture.

Pre-requisite: CHE 111

CHE 214: Biochemistry (3 credit units; 2-2)

This course is intended to integrate the basic concepts of biochemistry of plants and animals. It includes the study of important fluids in the organism, enzyme action, vitamin, coenzyme nucleic acids; bioenergetics. this course will also embrace a bio-organic approach to the chemistry of carbohydrates, lipids, proteins and the reactions of photosynthesis.

Pre-requisite: CHE 111, CHE 213

MTH 111: College Mathematics (3 credit units; 3-0)

This course is designed to give students an introduction into some of the application of mathematics in solving certain problem that may be encountered in everyday life, and a brief introduction to calculus. The topics covered include functions and relations; linear programming; quadratic equations; remainder

theorem; simultaneous quadratics; set; matrices; vectors; arithmetic and geometric progression; and introduction to calculus.

Pre-requisite: GCE/CXC Math of equivalent

MTH 112: Statistics (3 credit units; 2-2)

This course is designed to give students an understanding of statistical laws and principles and to enable them to use statistics in making decisions.

The course includes tabulation and representation of statistical data, measures of central tendency, cumulative frequency graph, variance and standard deviation, use of an assumed mean or a scale factor, arrangements and selections, probability distributions and frequency distributions, the normal distribution; general ideas of sampling and surveys, analysis of variance; and non-parametric tests.

Pre-requisite: MTH 111

MTH 213: Agricultural Mathematics (3 credit units; 3-0)

Applied mathematic including integration of agricultural problem which require mathematic skills such as developing feed rations, conversion ratios, formulating fertilizer mixtures, measuring land, volumetric measurements, calibration, and calculations of estimates and yield data.

Pre-requisite: MTH 111

MTH 315: Computer Science (3 credit units; 2-2)

The course MTH 215 will enable the student to acquire necessary micro computer application skills which the will utilize in their future careers. The course focuses on two concepts (1) Hardware: history of computers, their classification and application, input and output devices (2) Software: DOS, application programs, system security. Emphasis is given to microcomputer applications.

Pre-requisite: MTH 101

PHY 111: Physics 1 (3 credit units; 2-2)

This course is intended to provide students with an understanding of physical science as a background for courses in agricultural engineering technology. It covers units and measurement; base and derived quantities; density; thermal

physics - temperature and thermometers, kinetic theory of matter, expansion of solids, liquids and gases, transfer of thermal energy, heat capacity and latent heat, problem solving, evaporation, three gas laws. solar energy; static and current electricity, Ohm's Law, power and cost of electricity.

PHY 112: Physics II (3 credit units; 2-2

This course is a continuation of PHY 111 and covers magnetism; magnetic effect of current, motor, generator, transformer; diode and rectifier, capacitor; radio activity; motion, scalar and vector quantities, force, energy and power, momentum; three forces in equilibrium; moments; machines; pressure and pressure pump; light - reflection, refraction, dispersion of white light, electromagnetic spectrum; upthrust; rational motion; elasticity - Hurle's Law.

Pre-requisite: PHY 111

ZOL 112: Zoology - Animal Taxonomy (3 credit units; 2-2)

This course is designed to provide an understanding of special features and characteristics of organisms representative of the major phyla of the animal kingdom. Special emphasis is placed on organisms of agricultural importance, such as , platyhelminthes, nematodes, arthropods and chordates.

Pre-requisite: BIO 111

ZOL 213: Animal Physiology (3 credit units; 2-2)

This course is designed to integrate fundamental concepts and principles involved in the biochemical an biophysical processes of animal existence. It will focus of the physiological basis of husbandry and health of farm animals.

Pre-requisite: BIO 111, ZOL 112

Department of Plant and Soil Science

AET 211: Farm Power and Machinery (4 credit units; 3-2)

Sources and application of farm power; terms, definitions, functional requirements, and design; selection, maintenance, adjustment, and operation of tractors and equipment; small engine service, maintenance, and overhaul.

Pre-requisite: PHY 111 7112, MTH 111 & 112

AET 212: Farm Practice and Farm Mechanics

This course is intended to provide students with the opportunity to develop competence, knowledge, and attitudes which will enable them to apply theory to practice; to develop wise use and management of time and the factors of production; to produce a well-rounded graduate who can contribute significantly to development of agriculture.

The course covers identification and use of farm shop tools and equipment; safety measures in tool and equipment usage; servicing and operation of machines and equipment; construction and maintenance of farm structures basic principles of surveying and land measurement; planning and construction of contours, terraces, ditches, ponds, and other soil conservation devices. The duration of the course is fifteen week; evaluation is on a pass/fail basis.

Pre-requisite: PHY 111 & 112, MTH 111 & 112

AET 313: Farm buildings and Structures (3 credit units; 2-3)

Functional requirements and materials used in farm structures. Planning, construction, care and maintenance of livestock buildings, produce storage structures, equipment sheds, workshops, shade house, and other plant structure. Construction of farm roads, bridges and embankments.

AET 314: Small Engines (3 credit units; 2-3)

This course is intended to introduce students to small machines used in agriculture and to familiarize them with the problems associated with them and their operation solutions. topics to be covered include types of engines; principles of one cylinder, two cylinder engine; care and keep of engines; trouble shooting repairs and operations.

AET 316: Principles & Practices of Surveying (3 credit units; 2-3)

This course teaches the principles of land measurement to determine area; boundaries and to develop land maps; land levelling and contouring; layout of water ways, ponds, roads, fields, terraces, ditches, drains and structures.

Pre-requisite: MTH 111, PHY 112

AET 317: Irrigation & Drainage (3 credit units, 2-3)

This course in intended to make students aware of the importance of irrigation and drainage in agriculture. It includes the study of the principles and

practices of irrigation and drainage; water control systems; sources, quality and storage of water; measurement and management of soil water; and application of irrigation and drainage to crop production.

Pre-requisite: MTH 111, PHY 112, SLS 211

AET 319: Farm Mechanics Practicum

This course is essentially practice for students preparing for careers in agricultural engineering technology. Student get an opportunity through projects and lecture demonstrations to widen their skill base competence, and be fully conversant in the application of the practices of surveying, irrigation, drainage, farm structures, farm power and machinery.

The duration of the course is 15 weeks; evaluation is on a pass/fail basis.

Pre-requisite: AET 212

ENT 311: Fundamentals of Applied Entomology (3 credit units; 2-2)

ENT 311 is an elective course for students who choose the cluster of their electives in agronomy or horticulture to provide them with a deeper understanding of insect problems and their control, beyond that provided in PLS 314.

It covers fundamental insect morphology, anatomy and physiology; insect classification; insect and their environment; principles and methods of insect control; insecticide formulation; application and equipment; insect pests of major crop groups including floricultural crops; quarantine and insecticide laws.

Pre-requisite: BIO 111, BIO 112,PLS 210, PLS 314

ENT 312: Apiculture (3 credit units; 2-2)

This course focuses on types of bees and beehives; climate and beekeeping; life cycle of the honey bee the castes, resource needs of the colony; management considerations in beekeeping, materia; and equipment; extraction, grading and storage of honey.

Pre-requisite: BIO 111

FPT 311: Food & Nutrition (3 credit units; 3-0)

Study of the scope and principles of food science and technology. Food types, their source and nutritive values; the chemical composition of imported and local foodstuffs; post-harvest handling and the primary storage of foods; food habits and the importance of various categories of food to human nutrition.

Pre-requisite: CHE 111, CHE 213, BIO 111, BIO 111, BIO 112, ZOL 112

FPT 312: Food Microbiology (4 credit units; 3-2)

This course is intended to integrate basic concepts and techniques in microbial studies, as it relates to food science. Topics will include microbial classification, isolation, cultivation and identification of microbes of special importance to food and industrial microbiology. The morphology, ecology and physiology of selected bacteria, fungi, that affect food and food extracts; microbial action and the management and control of microbes.

Pre-requisite: BIO 111, BOT 112, CHE 111, 112, 213, ZOL 112

FPT 313: Food Engineering Systems (3 credit units; 2-2)

This course covers the study of food processing pathways; the mechanical consistency of particular foods along the pathways; the types of machines and structures necessary for each pathway; the servicing, maintenance and repair of processing machinery; the packaging process and packaging materials.

Pre-requisite: PHY 111, PHY 112, MTH 111

FPT 314: Food Processing Technology I (3 credit units; 2-3)

This course is devoted to the study and practice of the processing of crop produce. It covers food constituents and the chemical composition of local plant commodities; application of the principles of food preservation for particular crops which includes harvesting, post-harvesting handling, cleaning, blanching, and cooling; heat processing, dehydration, canning, freezing and the use of food additives; packaging and storage.

Pre-requisite: CHE 111, CHE 213, FPT 311, FPT 312

FPT 315: Food Processing Technology II (4 credit units; 2-4)

This course studies microbial application in the production of certain foods as bread, milk products, beers, syrup and liquors; the treatment and processing of

meat and dish to produce hams, bacon, sausage, pickled meats, corned meats, fillets.

Pre-requisite: CHE 111, CHE 213, FPT 311, FPT 312

HOR 214: Farm Practice - Horticulture

This is a practical course providing laboratory exercises for both PLS 310 and PLS 320. It equips students with the necessary skills in operating a plant nursery; selecting, organizing and developing necessary sites; proper usage of propagating structures and tools; growing selected fruit and ornamental plants; preparing and utilizing various rooting media; selecting and using plants in landscaping; growing and caring house plants; pruning of hedges, trees and vines; propagating various species of plants; and turf establishment and maintenance.

The duration of the course is 15 weeks; evaluation is on a pass\fail basis.

HOR 315: Fruit Production (3 credit units; 3-0)

This course targets the study of primary export fruit crops and minor fruit crops grown for local consumption. The course focuses on current crop production in Jamaica and the region; the nutritional contributions of these crops; the profitability of fruit production; the potential of these crops as major foreign exchange earners; problems associated with their acceptance; production and marketing of soft fruits; and the production principles and practices necessary to successfully grow each crop.

Pre-requisite: PLS 210, SLS 211

HOR 316: Floriculture (3 credit units; 2-2)

This is an elective course for students who concentrate their electives in horticulture. It is intended to provide them with a detailed study of floral plants under the headings of identification and classification; propagation and cultivation; harvesting, grading and packaging; storage and market quality; marketing and shipping procedures.

Pre-requisite: PLS 210, SLS 211

HRT 317: Species of Condiments (3 credit units; 3-0)

This course is intended for students who concentrate their electives in horticulture or agronomy. It focuses on the identification, classification,

production and utilization of spice and condiment crops as nutmeg, mints, ginger, cinnamon, annatto, pimento, black pepper, thyme, vanilla, kola.

Pre-requisite: PLS 210, SLS 211

HOR 318: Fundamental of Landscaping (3 credit units; 2-3)

This course is an introduction to the principles and practices involved in the integration of buildings, trees and other objects to produce desired effects. It covers reasons for doing landscaping; types of landscapes and their variations; arrangement of plants in the landscape; suitability of plants for each type of landscape; planning and designing landscape projects; and tools and equipment used in landscaping.

Pre-requisite: PLS 210

HOR 319 (PLS 320): Horticulture Practicum

this course is essentially practice for students preparing for careers in horticulture. The student is given an opportunity to manage a small operation which includes tools, equipment management; be supervisor of a small labor force; and be the decision maker regarding what to produce, how to produce, and in what quantities, utilizing the knowledge, competence and attitudes learnt from PLS 210, PLS 320 and HOR 214.

The duration of the course is 15 weeks; instruction and practice will be given for 16 hours per week; evaluation is on a pass or fail basis.

HOR 320 (PLS 320): Nursery Production & management (3 credit units; 2-2)

Stock plant production, propagation and finishing. Propagating structures and environment. Management considerations.

Pre-requisite: BOT 111, BOT 112, BOT 213, SLS 211

PLS 210: Principles of Crop Production (3 credit units; 3-0)

The course introduces students to the scientific base of crop production. It covers crop distribution and adaptation; crop establishment and maintenance; seeding methods; selecting seeds and planting materials; transplanting and seed bed preparation; systems of crop production; fertilizing; weed, insect and disease control; harvesting and storing.

Pre-requisite: BIO 111, BOT 213, SLS 211

PLS 215 (213): Farm Practice - Crop Production

This course is the laboratory for PLS 210, PLS 320 and some electives. It is intended to provide students with an opportunity to develop competence, knowledge and attitudes which will enable them to apply theory to practice; to develop wise use and management of time and the factors of production; to provide a well-rounded graduate who can contribute to the development of agriculture.

The course covers the practice of site selection and preparation, tool identification and usage; field layout; seed bed preparation, sowing of seed and transplanting; planning of cropping system, disease, insect and weed control; safe usage of pesticide; and the pruning of various crop species.

The duration of the course in 15 weeks; instruction will be given for 16 hour per week; evaluation is on a pass or fail basis.

PLS 314: Plant Protection (4 credit units; 3-2)

Plant diseases and pest of economic importance; disease-causing organisms, pathogen and host/parasite interactions; factors affecting disease development, spread and their control measures; identification of insects and nematodes; factors affecting insect dispersal and migration; methods of assessing crop damage by pests. Pest control. Weed control methods and safe use of herbicides.

Pre-requisite: BIO 111, BOT 112, BOT 213, CHE 111, CHE 213

PLS 316: Forestry (3 credit units; 2-2)

The course covers general principles and practices of forestry and natural resource management. Topics include principles of silviculture; wood technology including tree anatomy and physiology; forest ecology; wildlife and range management; principles of forest protection; forest harvesting; and cultivation of selected Jamaican forest trees.

Pre-requisite: BIO 111, BOT 112, BOT 213, SLS 211

PLS 317: Plant Breeding (3 credit units; 2-2)

This course is intended to enable students to develop and appreciation of the role of plant breeding in crop production; to provide students with the fundamental concepts and principles of plant breeding; to expose them to the

techniques and practices of breeding in selected crops of significance to export and local consumption.

Pre-requisite: BIO 112, BIO 213, MTH 111

PLS 319: Crop Production Practicum

This course is essentially practice for student preparing for careers in crop production. The student is give the opportunity to make production decision using the knowledge, competence and attitudes learnt from PLS 210, PLS 215 PLS 320.

The duration of the course is 15 weeks; instruction and practice are provided for 16 hours per week; evaluation is by pass\fail.

Pre-requisite: PLS 210, PLS 215

PLS 320: Crop Production Practices (3 credit units; 3-0)

This course is an introduction to culture of specific crops that are important to Jamaica and the region. It allows students to link principles with actual practices. The course focuses on the importance of the crop to the region; the various systems suitable for their production; the environment to which such crops are adopted and grown; varieties currently i use; specific disease, insects affecting the crops; the techniques used in their production; types and methods of fertilizers and other chemical used to grow the crop; harvesting techniques adopted for each crop; utilization of the crop.

Pre-requisite: PLS 210

PLS 322: Non-traditional & Root Crops (3 credit units; 3-0)

This course is intended to involve students in the scientific study and production of crops that are of economic importance but are not popularly grown, for example alo vera., lychee, cho cho, asparagus and cherri moya. It also covers the study of root crops such as yams coco-yams, cassava, sweet potato, dasheen, tumeric, arrow root.

Pre-requisite: PLS 210, SLS 211

SLS 211: Introduction to Soil Science (3 credit units; 3-2)

The intent of this course is to introduce beginning student to the nature and properties of soils in relation to crop production. It focuses on the origin,

formation and composition of soils; their functions as a natural active body for plant growth; rock and mineral and their relationship to soil types, and properties; the geology of Jamaica; properties of rocks and minerals; soil sampling and surveys; soil water and air; soil structure and texture, soil classification , soil physical and chemical properties; and soil organic matter; properties and functions.

Pre-requisite: BIO 111, CHE 111

SLS 312; Soil Fertility Management (3 credit units; 2-2)

To present the fundamental principles of plant growth; and the use of fertilizer, other soil amendments, and all other manipulations of the soil to improve productivity of the soil. Course content include definitions and terminologies; plant growth factors; need for soil fertility, management; elements of plant nutrition; the manufacture and properties of mixed fertilizers; soil and plant relations; liming and acidity; fertilizer application; crop systems and soil management; attacking soil problems.

Pre-requisite: SLS 211

SLS 313: Soil Conservation and Watershed Management (3 credit units; 2-2)

This course highlights problems which can develop when management of crop and soil is inadequate. It focuses on land (soil) loss in relation to declining productivity; decline of natural resources; it establishes a need for resource conservation; how soil is lost; methods of preventing soil loss; methods of reclaiming damaged land; concepts of watershed management; land capability classification; management of hillside lands; water management; and the selection of crop species, land, production systems and conservation method to prevent land wastage.

Pre-requisite SLS 211

General Agriculture Courses

AGR 211: (CIE 211) Cooperative Internship Education (6 credit units; 0-40

The course is intended to provide a balance between theory and practice in agriculture; develop in students positive work attitudes towards agriculture; and to introduce students to real-world situations.

The students are placed in agricultural businesses and allied industries according to their interests. The attachment is to provide each student with

supervised work experience over an eight-week placement. Upon completion, the student prepares a report of the internship experience.

Monitoring of students in the field is carried out by members of the faculty of the College of Agriculture. On-the-job supervisors complete an evaluation of the student's job performance, human relations, and personality factors. Workplace evaluation and the evaluation of the student's report is done by members of the faculty of the College.

AGR 316: Research Methodology (3 credit units; 2-2)

This senior level course is designed to provide an opportunity for students to develop research capabilities including statistical analysis, interpretation, plot design and layout, data collection, sociological surveys, technical report writing, literature reviews, oral presentations and proposal writing; and to enable students to successfully develop field projects.

Pre-requisite: ENG 213, MTH 112

Courses by Semester

YEAR I: SEMESTER I

Course No. & Title	Hours			
	Lect	Lab	F/Prac	Credit
AET 212: Farm Practice (Farm Mech)	-	-	16	P/F
BIO 111: Biology	3	2		4
CHE 111: Inorganic Chemistry	3	2	-	3
ENG 111: Use of English	3	-	-	3
MTH 111: College Mathematics	3	2	-	4
MTH 101: Int to Computer Science	-	4	-	-
EDF 111: Foundations of Education	3	-	-	3
PHY 111: Physics I	2	2	-	3
Total	17	12	16	20

YEAR I: SEMESTER II

Course No. & Title	Hours			
	Lect	Lab	F/Prac	Credit
ANS 112: Farm Practice (Livestock)	-	-	16	P/F
BOT 112: Botany: Taxonomy	2	2	-	3
CHE 213: Organic Chemistry	2	2	-	3
ENG 112: Communication Skills	3	-	-	3
MTH 101: Int to Computer Science	0	4	0	0
EDF 111: Foundations of Education	3	0	0	3
PHY 112: Physics II	2	2	0	3
ZOL 112: Zoology: Taxonomy	2	2	0	3
Total	14	12	16	18

YEAR II: SEMESTER I

Course No. & Title	Hours			
	Lect	Lab	F/Prac	Credit
AET 211: Farm Power & Machinery	3	2	0	4
BIO 212: Microbiology	3	2	0	4
BOT 213: Plant Physiology	2	2	0	3
PLS 215: Farm Practice (Crop)	0	0	16	P/F
SLS 211: Int to Soil Science	3	2	0	4
SOC 211: Sociology	3	0	0	3
ZOL 213: Animal Physiology	2	2	0	3
Total	16	10	16	21

YEAR II: SEMESTER II

Course No. & Title	Hours			
	Lect	Lab	F/Prac	Credit
AEC 212: Farm Business Management	3	2	0	4
ANS 210: Pcple of Livestock Production	3	0	0	3
BIO 214: Genetics and Breeding	3	2	0	3
EDF 213: Fund. of Program Development	3	0	0	3
HOR 214: Farm Practice (Horticulture)	0	0	16	P/F
PLS 210: Pcple of Crop Production	3	0	0	3
PLS 314: Plant Protection	3	2	0	4
Total	18	6	16	21

YEAR III: SEMESTER I

Course No. & Title	Hours			
	Lec	Lab	F/Prac	Credit
AED 313: Tching in Agric. or EED 312	3	0	0	3
EED 312: Pcple & Prac of Extension	3	0	0	3
AGR 316: Research Methodology	2	2	0	3
ANS 313: Animal Nutrition	2	2	0	3
ANS 314: Veterinary Science	3	2	0	4
Farm Practice Elective	0	0	16	P/F
Electives	4-6	0-6	0	3-6
Total	14-16	6-12	16	17-19

YEAR III: SEMESTER II

Course No. & Title	Hours			
	Lec	Lab	F/Prac	Credit
AEC 314: Agricultural Marketing	3	0	0	3
ANS 320: Livestock Production Practices	3	0	0	3
PLS 320: Crop Production Practices	3	0	0	3
SLS 312: Soil Management	2	2	0	3
Farm Practice Elective	0	0	16	P/F
Electives	4-6	0-4	0	4-6
Total	15-17	2-6	16	16-18

SUMMER SESSIONS

YEAR II

Course No. & Title	Hours Lec	Lab	F/Prac	Credit
AEC 211: Fund. of Agricultural Economics	3	0	0	3
MTH 112: Fund. of Statistics	2	2	0	3
Total	5	2	0	6

YEAR III

Course No. & Title	Hours Lec	Lab	F/Prac	Credit
AGR 211 (CIE 211): Cooperative Internship Education	0	0	40	6

VITA

James McKenzie was born in St Ann, Jamaica. He attended Dinthill Technical High School, graduating in 1966. He graduated from the Jamaica School of Agriculture in 1979; The University of the West Indies, St Augustine in 1974 and Mona in 1983; and Michigan State University in 1980. He holds the Bachelor of Science degree and the Diploma in Management Studies from The University of the West Indies and the Master of Arts degree from Michigan State University. He has worked as agricultural teacher at Grange Hill Secondary School; senior education officer in the Ministry of Education, Jamaica; principal of Elim Agricultural School; and Project Coordinator of GOJ/USAID Jamaica Agricultural Education Project, which established the College of Agriculture. He entered the School of Vocational Education at Louisiana State University in January 1990 to read for the degree of Doctor of Philosophy.

DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: James D. McKenzie

Major Field: Vocational Education

Title of Dissertation: Curriculum Needs of Entry-level Agribusiness Managers in Jamaica

Approved:

Satish Verma
Major Professor and Chairman

Daniel Foss
Dean of the Graduate School

EXAMINING COMMITTEE:

Michael J. Burnett

Barbara A. Hall

Donnie R. Vaden

William B. Richardson

Date of Examination:

March 30, 1993