Division 403
Organization, Communication
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Institutional Development of
Research Institutions in
Developing Countries

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PREFACE

The article by Moses N. Kiggundu, School of Business, Faculty of Social Sciences, Carleton University
(Ottawa, Canada) is the result of a bigger research project supported by the International Development
Research Centre (IDRC). The article appeared - apart from discussion papers in IDRC - first in the Journal
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article in the publication series of GTZ - Division "Organization, Communication and Management
Consultancy".

We believe that the restructuring of research institutions worldwide has just begun and that the efforts of
ISNAR for example or more specifically of IRRI, in the field of agricultural research institutions, should be
supported by the view of practitioners and researchers in organizational development to enrich the discussion
and the practical relevance of approaches.

Moses N. Kiggundu has contributed greatly to structuring the organizational model for research institutions
and to work out the parameters to diagnose research institutions in detail. His generic model can be applied to
the various sectors and is an excellent approach to encourage research institutions to also use the model as
an instrument for self-diagnosing their situation. The model of Moses N. Kiggundu links to research and
practical work of Renata Kiefer who has improved the work of a national health research institution in
Paraguay by using methods of organizational and personnel development and to the work of Manfred Habig
with a national agricultural research institute in Ecuador, to quote but a few examples of the continuous efforts being undertaken in the various sectoral activities of GTZ, namely Health and Agriculture.

Hence, the organizational development of research institutions not only in developing countries can hopefully become more systematic in the near future as far as diagnosis, management and development is concerned - and thus integrate the views of different disciplines.

Dr. Rolf Sulzer
Head of Division 403
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There is an increasing recognition that the survival and development of civilization depends on the nature and functioning of society's institutions (Gulick and Urwick, 1954; Kiggundu, 1989). Accordingly, much effort has been directed towards the study and changing of institutions in various cultural (Hofstede, 1980), economic (Williamson, 1985), political and ideological settings (Nee, 1992). The literature is full of various approaches to the study of institutions in various settings. Examples include general institutional approaches (Eaton, 1972; Blase, 1986; Brinkerhoff and Goldsmith, 1990), sectoral approaches such as agricultural (Nickel, 1989; von der Osten-Sacken, 1992), child care centers (Baum and Oliver, 1991), public sector (Aharoni, 1986; Plumptre, 1988), local institutions (Honadle and Van Sant, 1985; Uphoff, 1986; Ostrom et al., 1989), regional (Rwegasira, 1988; Jaeger and Kanungo, 1990) and by donor or funding agency such as the World Bank (Israel, 1987) and LjSAID (Rondinelli, 1987). All these efforts and approaches are directed towards the development of high-performing institutions for enhancing human development and the preservation of civilization.

In spite of all these efforts, the study of institutions still remains fragmented with no comprehensive theory acceptable and relevant to different types of institutions in different development contexts. Specifically, there is no integrated theory of institutional analysis and development for research institutions for developing countries.

A recent literature review concluded that there is no comprehensive theory-based and empirically grounded model for the analysis and diagnosis of research institutions in developing countries, and that there is no single source or commercially published book on the development and management of research institutions in developing countries (Kiggundu, 1991, p. 20).

The purpose of this article is to develop and empirically test a conceptual model for the analysis, management and development of research institutions in developing countries. The case for the analysis and development of effective organizations for developing countries has been made (Kiggundu et al., 1983; Kiggundu, 1989) and will not be repeated here. It is important to focus on research institutions as a subset of organizations in developing countries for several reasons. Firstly, as has been indicated above, the study of research institutions as organizations has received very little attention compared with other types of organizations such as state-owned enterprises (Shirley, 1983; Goyal, 1984; Powell, 1987), non-governmental organizations (Brodhead and Herbert-Copley, 1988) or even village organizations (Korten and Alfonso, 1983; Uphoff, 1986). Secondly, research institutions have the potential to make significant contributions to more balanced human development for developing countries by producing useful knowledge drawing on both the Western methods of scientific enquiry and indigenous knowledge systems. In most developing countries, this potential has not been fully developed.

Thirdly, developing countries continue to play a minor role in the field of science, research, development and technology, contributing no more than 3 per cent to the world's stock of new technology (Steward, 1979). This marginalizes them as participants in the global economy and new world order. It also makes them vulnerable, and dependent on Western sources for new knowledge and technology. These sources have built-in biases which inhibit the effective application of such knowledge and technology (Kiggundu, 1989). Fourthly, most of the people working in and running research institutions, including donor representatives, do not necessarily recognize the organizational imperatives of their actions. Often trained in engineering or scientific disciplines, they do not fully appreciate the managerial and administrative implications and requirements for their institutions. Instead, they tend to focus almost exclusively on research operations. The model to be presented here will provide a systematic and more balanced understanding of research institutions as organizations...
operating within a dynamic task environment.

Finally, there is suggestive evidence pointing to the view that many research institutions in developing countries are weak in critical operating and strategic organizational functions such as administration, supervision, management and leadership (Black, 1990; Coulter, 1987; Commonwealth Research Council, 1982; White 1990). The model proposed in this article provides framework for the analysis and diagnosis of such institutions with implications for prescriptions for managerial improvements. It also provides a basis for the development of research institutions deeply rooted within their immediate environment using indigenous management models (Mendonca and Kanungo, 1992).

According to Uphoff (1986, p. 9) institutions are 'complexes of norms and behavior that persist over time by serving collectively valued purposes'. They are characterized by rules structures and roles. The term, as used here, is akin to organizations (Kiggundu, 1989, p. 16) as open systems with differentiated and integrated critical operating and strategic management tasks. Accordingly, research institutions are conceptualized as having structures and processes operating in a dynamic context made up of both the general and task-specific external environment. This environment is dynamic in both temporal and spacial dimensions.

MODEL FOR RESEARCH INSTITUTIONS

As indicated above, the aim was to develop an organizational model for research institutions in developing countries. At the outset, it was decided that the model would have to meet the following criteria:

- relate specifically to research institutions;
- be general enough to encompass a variety of research institutions in various sectors, disciplines and regions of the developing world;
- be comprehensive enough to include all the various parts, hierarchies and subsystems common to research institutions;
- be specific enough to provide a meaningful framework for the analysis of such institutions, and for the development of diagnostic tools for institutional assessment, intervention and development;
- be testable: by providing definable and potentially measurable variables for both empirical and descriptive institutional research; and
- be potentially useful and usable by the research institutions, their holding or supervising ministries or departments, as well as donor and funding agencies.

Table 1 provides a detailed outline for the four dimensions of the model and their respective sub-dimensions. The four dimensions are:

- Strategic management (SM);
- Collaborative institutional arrangements (CIAs);
- Internal management, administration and supervision (IMAS); and
- Research operations (ROPs).

**Strategic management (SM)**

This dimension involves a combination of leadership and management in three basic areas:

- the dynamic relationships between the research institutions and the external environment, both domestic and international;
- internal management, supervision and administration; and
• planning for the future development of the research institution including building long-term sustainable collaborative institutional arrangements with other organizations sharing similar needs or objectives.

In most cases, these functions involve creation of the research institution’s character or mission, giving it the image, values and uniqueness that distinguishes it from others; legitimizing that image and value system; formulating strategies for the effective acquisition and use of resources for the achievement of the mission objectives; managing the external environment to take advantage of emerging opportunities and defending the institution against potential threats; and providing leadership and supervision to other members of the institution.

Table 1: Dimensions of institutional support and strengthening

1. Strategic Management (SM)

1.1 Institutional Leadership

1.11 Environmental Scanning
1.12 Development of Institutional value system
1.13 Visioning
1.14 Missioning
1.15 Strategizing
1.16 Institutional Planning

1.2. Managing External Interfaces

1.21 Research/extension
1.22 Clients/Users
1.23 Governmental/political groupings
1.24 Researches/publishers
1.25 Funding Sources
1.26 Supplier's of Strategic Resources

1.3. Strategic Resource Acquisition and Utilization

1.31 Financial resources
1.32 Human resources: scientific, technical, managerial
1.33 Strategic research topics
1.34 Research infrastructure and physical facilities
1.35 Political, scientific and community support and respect
1.36 Status, power and influence
1.37 Accessibility: individuals, groups, institutions

1.4 Internal Leadership

1.41 Staffing: Recruitment, motivation, training, development, general supervision
1.42 Accountability systems
1.43 Research supervision
1.44 International communications, interactions and dissemination
1.45 Organization development and change

2. Collaborative Institutional Arrangements (ClAs)

2.11 Joint environmental scanning
2.12 Joint Research Administration
2.13 Joint Research Operations
2.14 Joint Utilization of Technical Assistance

The four sub-dimensions of strategic management are: (a) leadership, (b) managing external interfaces, (c) strategic resource acquisition and utilization and (d) internal leadership. Table 1 gives a total of 24 elements for these four sub-dimensions of institutional strategic management.

Collaborative institutional arrangements (CIAs) - Co-production

Research institutions in developing countries, as elsewhere in the world, do not exist in isolation but are linked in a complex web of institutional interdependencies. Collaborative institutional arrangements involve the deliberate and strategic management of these interdependencies for the long-term benefits of the research institution. Collaborative institutional arrangements must be distinguished from personal collaborative arrangements by individuals from two or more separate institutions. For the former, the institution as whole, not individuals, is the subject of collaboration and unit of analysis or intervention.

3. Internal Management Administration and Supervision (IMAS)

3.11 Library/document/information
3.12 Finance, accounting and administration
3.13 Research equipment, infrastructure, and physical plant
3.14 Human resource management
3.15 Marketing and public relations

4. Research Operations (ROPS)

4.1 Determining Appropriate Research Topics (RT)
4.11 Literature Search
4.12 National plans and policy framework
4.13 Networking
4.14 Socio-technical systems: beliefs, norms, institutions, infrastructure
4.15 Market research: indigenous knowledge systems
4.16 Donor influence

4.2. Research Production (RP)
4.21 Research design
4.22 Research execution
4.23 Research analysis
Collaborative institutional arrangements can be strategic or operational. They are strategic if they involve the overall leadership and management of the institution and its relationships with its external environment over a relatively long period of time. For example, statements about institutional isolation and the need to forge long-term relationships with other research, training and extension organizations relate to the need for strategic collaborative arrangements. Operational collaborative arrangements, on the other hand, involve collaboration over specified institutional tasks. Examples include joint research, operations such as library or computing facilities, teaching, purchasing and procurements. These tend to be short term and terminate as soon as the joint task has been accomplished. Also, collaborative institutional arrangements can be local, national, regional, south-south, south-north or international. The main consideration is that they must relate directly to the research institution's mission and objectives. The four elements of collaborative institutional arrangements point environmental scanning, research administration, etc.) shown in Table 1 are only illustrative, not exhaustive, of all possible areas of collaboration among research institutions.

Internal management, administration and supervision (IMAS)

This covers all areas of the internal management, administration and supervision of the research institution. The work can be routine but it requires a creative combination of technical skills (e.g. accounting, plumbing, vehicle maintenance, etc.) and managerial skills (e.g. staff supervision, planning, budgeting) with a working knowledge of the environment within which the research institution lives and operates. As shown in Table 1, examples include the internal management of information, research equipment, human resources (including technicians, scientists and researchers) and marketing and public relations.

Research operations (ROPs)

This is the area most commonly identified with research institutions. In fact some models of research institutions focus exclusively on this area and neglect all the others discussed above. Also, those primarily
interested in the successful implementation of specific research projects, especially those externally funded, tend to concern themselves almost exclusively with research operations (ROPs) as defined here.

The five sub-dimensions of research operations for research institutions are: (a) determining appropriate research topics (RT); (b) research production (RP); (c) research dissemination (RD); (d) research utilization (RU); and (e) research feedback (RF). These, together with a total of 24 elements for research operations (ROPS) are shown in Table 1.

**Relationships and complexities**

The four dimensions discussed above do not exist in isolation or independent of one another. Rather, in a functioning research institution, they should be hierarchically and functionally interrelated in a complex network of interdependencies. Figure 1 shows the functional relationships among the four dimensions. On the left-hand side, the figure shows the corresponding attributes, knowledge, skills and abilities (KSAs) required for the effective performance of the functions associated with each of the dimensions. For example, as discussed elsewhere (Kiggundu, 1989), leadership qualities are critical for strategic management (SM) and collaborative institutional arrangements. Research skills and a scientific value system are critical for the effective performance of research operations (ROPs) functions. In between, one needs a proper combination of technical, administrative and managerial skills and indigenous knowledge systems for the effective performance of internal management, administration and supervision (IMAS) functions.

It is the acquisition, retention and effective utilization of this skills mix operating within a scientifically driven value system that makes for effective research institutions. Yet, we know so little about the factors, which create and sustain these organizational competencies for research institutions in the context of developing countries.

*Figure 1. Relationship between the dimensions of research institutions*
The right-hand side of Figure 1 shows the areas where most donor-supported technical assistance to research institutions in developing countries tends to be concentrated. Specifically, donor-funded initiatives are often concentrated in the functional areas of research operations (ROPs) such as research production, dissemination and use. Some donors include elements in the technical areas of IMAS such as information systems, research equipment, human resource development and office administration. Most donors, however, pay little or no attention to the areas of strategic management. In a recent review of the type of support given to research institutions by an international donor agency, it was observed that, in relation to strategic management, the donor agency is timidly nibbling on a problem that requires big bites. Also, it is not clear if 'it is biting where it matters most' (Kiggundu, 1991, P. 19).

Figure 2 further illustrates the relationships and complexities among the four institutional dimensions and their components. For example, strategic management is made up of four component functional areas of institutional leadership: managing external interfaces, strategic resource acquisition and utilization and internal leadership. In essence, these plus strategic collaborative arrangements constitute the key areas of
responsibilities for the top management of research institutions. For example, in its 25-year anniversary statement, the International Rice Research Institute (1985) provides examples of strategic management and collaborative arrangements with national agricultural systems of several Asian and African countries and the University of the Philippines at Los Banos and the Consultative Group on International Agricultural Research (CGIAR). Unfortunately, effective strategic management is not common among organizations in developing countries (Black, 1980; Rwegasira, 1988; Kiggundu, 1989; Jaeger and Kanungo, 1990).

An important but often neglected dimension for the effective management and operation of research institutions is IMAS, the components of which are shown in Figure 2. This dimension relates to the acquisition, development, maintenance, supervision, effective use and renewal of technical, scientific, human, financial, informational, infrastructural and other resources important for the leadership, administration and operation of a high-performing research institution. Examples include research equipment, library and information resources, highly skilled and experienced scientists, technical and administrative staff, physical plant, financial resources and a scientifically driven but locally grounded organizational culture and value system.

These resources require both general and highly specialized technical expertise and should be both structurally and functionally linked to both the strategic management and operations of the research institution. For example, expensive research equipment, often bought or donated from abroad, requires a complex system of human and institutional infrastructure for its installation, operation, maintenance and adaptation to local conditions and requirements. Unfortunately, most research institutions in developing countries lack the institutional capacity to perform these and similar IMAS critical functions on an effective and sustainable basis. Moreover, donor agencies are reluctant to provide support in these areas because of their recurrent implications. Yet, the strength of the research institution, both strategically and operationally, depends on the extent to which both management and the scientists can individually and collectively draw on an effective and dependable institutional internal administrative system and local technological capacity (Kiggundu, 1989).

Figure 2 also shows the various components of research operations. These include the determination of research topics and priorities, the conduct of the research, dissemination (publications, workshops, demonstrations, etc.), research feedback (e.g. from scientific, industrial and government organizations) and research use (extension, commercialization, training, policy dialogue, etc.). Although these functions appear at the bottom of Figure 2, they are significantly different from the operations of a traditional industrial organization because research institutions are professional bureaucracies. Accordingly, they are characterized by operator (scientists) specialized training and indoctrination, high need for professional rather than institutional autonomy and potential conflict between personal or professional needs and institutional strategies (Mintzberg, 1979). Also, since research institutions in developing countries operate in an environment of resource scarcity, the leadership and motivation of scientists and researchers in the direction of the institute's corporate strategy must be one of the most difficult management challenges.

In the literature some elements of research operations are neglected more than others. More attention is paid to research operations (Nickel, 1989) than research topics, and donors in particular tend to support only those research operations directly relevant for the implementation of specifically funded research projects. The need to develop an overall institutional capacity for identifying appropriate research topics and priorities, receiving constructive feedback from potential clients, users and strategic supporters, and using the results of the research for scientific, social, economic and policy development is often neglected. Yet, these functions are so important for the long-term viability of the research institute that they should be classified as strategic rather than operational. For example, the determination of appropriate research topics and priorities for a research institution in a developing country is a strategic decision which must be made on the basis of both internal institutional capabilities as well as external (national) environmental scanning of important stakeholders, their needs and interests. Similarly, research dissemination and use should be based on the identification of strategic clients, users and supporters of the institution and its research mission and information. Leaving these functions only to operational or purely scientific considerations could leave the research institution without a strategic mission or with a hostile task environment (Edwards, 1988; Easter et al. 1989).
TEST OF THE MODEL

Several methods were used to test for the validity of the institutional model presented above. The primary objective was to find out the extent to which current theory and practice with respect to research institutions supports the existence of the dimensions as outlined above. The two primary sources of data were: (a) selected literature review and b) summaries of evaluation studies of active research institutions operating in various regions of the developing world.
Also, the author obtained access to internal documents and active field projects from a major international development donor agency. The internal documents provided background information, historical evolution and internal debates and approaches to institutional support for research institutions in developing countries. Information from field projects was also useful because these projects were specifically designed to provide institutional support for the research institutions, rather than direct support for the conduct of research. However, project documents did not provide adequate information for a detailed analysis for testing the model presented above.

Literature review

A computerized library search was conducted for the key words "institution building", "development", "management", "capacity building" for research institutions in developing countries. Over 7,000 items were generated, but in the interests of time a smaller sample had to be selected. The criteria used for the selection of the items were: (a) the item had to relate to the organization, management or capacity building of research institutions; (b) the item was focused on institutions in developing countries; (c) it was published or written in the last 10 years and (d) it was written in English. Attempts were also made to achieve regional and sectoral representation. This approach is similar to the method used by Kiggundu et al. (1983) in their study of administrative theory and practice in developing countries.

In all, 34 priority items were identified but because of time limitations and lack of sufficient details for some of the studies only 10 studies were reviewed and analyzed.

Evaluation studies

It is common for research institutions in developing countries to undergo a comprehensive institutional assessment or evaluation. These evaluation studies are conducted for a variety of reasons including: (a) providing institutional performance feedback to major supporters, especially international donor and leading agencies; (b) assessing the institute’s institutional capacity to undertake new programs or mandate; and (c) initiating or terminating a long-term program of support by one or several donor agencies.

Five such institutional evaluations from Anglophone Africa, Francophone Africa and Latin America were selected and analyzed for this study. The purpose of reviewing these evaluation studies was to analyze the issues identified by the evaluators in terms of their relevancy and applicability for strengthening research institutions in developing countries. Accordingly, each of the issues identified by the evaluators was classified in terms of the institutional dimensions and sub-dimensions of the model presented above.

These five institutional evaluation studies were selected for several reasons. Firstly, they focus on a wide range of systemic institution-wide issues and are not limited only to project- specific concerns. Secondly, they were conducted by joint evaluation teams made up of members of the institution, outside consultants, government policy-makers, scientists from similar institutions and representatives of donor agencies. They were therefore quite comprehensive and objective. Thirdly, they represented different regions and sectors of the developing world.

RESULTS

Literature review

Table 2 summarizes the results of the analysis of ten studies of research institutions in developing countries.

Specifically, it provides the name of the author(s), date of publication, name or type of institutions studied, country or countries where they are located and the institutional dimensions emphasized by each of the study. There is a wide range of types of research institutions from agriculture (White, 1990) to scientific and technical research (Black, 1980). Likewise, the studies cover a wide range of developing countries representing all regions of the developing world.

Each of the institutional dimension identified with each study in Table 2 has been labeled according to the classification given in Table 1. This was done in order to determine the extent to which the dimensions discussed by each of the studies reviewed could be matched with the dimensions as developed in the model. It also provides further operational understanding of the model's dimensions and sub-dimensions.
<table>
<thead>
<tr>
<th>Reference</th>
<th>Research institutions studied</th>
<th>Institutional dimensions emphasized</th>
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</thead>
</table>
| L. G. White (1990) | 1. The Superior Institute of Agriculture Dominican Republic  
2. Alemaya University of Agriculture Ethiopia  
3. Ten state agricultural universities (SAUs), India  
4. Bogor Institute, Indonesia  
5. Banda Agricultural College, Malawi  
6. Hassan II Institute of Agriculture, and Veterinary Medicine (IAV), Morocco  
7. Ahmadu Bello, Ife, and the University of Nigeria, Nsukka  
8. Kasetsart University, Thailand | 1. External support from international, community (SM 1.26)  
2. National political support (SM 1.23)  
3. Organizational incentives within the institutions (IMAS 3.14)  
4. Linkages with other similar institutions (CIAs 2.1)  
5. Institutional leadership (SM 1.1)  
6. Strategic management (SM 1.1) |
| Easter et al. (1989) | Twenty-seven state agricultural universities SAUs), India | 1. Support from the government of (India, through the Indian Council of Agricultural Research (ICAR) (SM 123)  
2. Donor support (Ford, Rockefeller, USAID, etc.) including six US land grant universities (SM 1.25, 1.26)  
3. Strong leadership from first generation of vice-chancellors (SM 1.1)  
4. Clear and shared goals and objectives for the SAUs (SM 1.1)  
5. Continuing scientific, technological, financial and administrative developments (IMAS 3.11-3.15)  
6. The integration of social and behavioral science in agricultural research (ROPs 4.14)  
7. Research as a common good (‘tragedy of the commons’) (SM 1.22) |
| Sanders et al. (1989) | Four Brazilian agricultural research universities (EMBRAPA) | 1. Strong international financial support (USAID) (SM 1.25)  
2. Collaboration with US universities (CIAs 2.1)  
3. Strong undergraduate teaching (RU 4.41; RD 4.32)  
4. Brazilian economic miracle (1968-74) and economic development (1966-80) (SM 1.11)  
5. Development of the (agricultural) private sector (RU 4.44) |
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Topic</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Ahmadu Bello University</td>
<td>2. Constant environmental change and unpredictability (SM 1.1, 1.2, 1.3, 1.4, 2.1)</td>
</tr>
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<td></td>
<td>2. University of life</td>
<td>3. Lack of research infrastructure and institutional research culture (SM 1.12; IMAS 3.13)</td>
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<td></td>
<td>3. University of Nigeria 2.1</td>
<td>4. Inappropriate or inconsistent research policies, program and commitment (SM 1.16; ROPs 4.12)</td>
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<td>5. The British administrative legacy and 'rules of the game' (SM 1.12)</td>
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<td>6. High transaction costs for the development of research institutions in Nigeria (SM 1.1; IMAS 3.15)</td>
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<tr>
<td></td>
<td></td>
<td>2. Strengthening the administration and supervision of research (IMAS 3.13, 3.14; ROPs 4.1-4.5)</td>
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<td></td>
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<td>3. Strategic management of research systems (SM 1.1-1.4)</td>
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<td>4. Inadequate human, financial, physical and technological resources (e.g. for operations and maintenance) (ROPs 4.1-4.5)</td>
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<td>5. Weak, collaborative institutional arrangements at home and abroad (CIAs 2.1)</td>
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<td></td>
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<td>6. Poor utilization of research resources (RU 4.41-4.44)</td>
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<td></td>
<td></td>
<td>7. Weak institutional scientific value system (SM 1.12; ROPs 4.14)</td>
</tr>
<tr>
<td>Caribbean Agricultural Research and Development Institute (CARDI) (1985)</td>
<td>Agricultural research institutes in the Commonwealth Caribbean (CARICOM) region</td>
<td>1. Need to pay attention to policy and infrastructure improvements (SM 1.4, 1.45)</td>
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<td></td>
<td></td>
<td>2. Need to compute research benefits beyond technical research results (RU 4.41-4.44)</td>
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<td>3. Fragmentation of regional research efforts (CIAs 2.1)</td>
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<td></td>
<td>4. Unrealistic expectations of the benefits from technology developments (SM 1.13; RU 4.41-4.44)</td>
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<td></td>
<td>5. Ineffective utilization of scarce research</td>
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</table>
resources (IMAS 3.11-3.15)
6. Need to attract more external funding (SM 1.25)
7. Need to develop consensus on research goals and strategies (SM 1.1, 1.45)
8. Mobilization and strategic allocation of resources (SM 1.15; RP 4.26)

United Nations University-Central Food Technological Research institute (1979)
Research and development in various developing countries
1. India
2. Bangladesh
3. Thailand
4. Korea
5. Sri Lanka
6. Mexico
7. Ghana

Management problems of R&D institutes as organizations:
1. The structuring of R&D institutions in developing countries (SM 1.4)
2. Technology selection, transfer and evaluation (ROPs 4.1, 4.4)
3. Selection of projects (RT4.1)
4. Human resource management especially staff motivation (SM 1.32; IMAS 3.14)
5. Communication and information (technology, resources) (SM 1.44; IMAS 3.11, 3.15; RD 4.31, 4.34)
6. Financial matters (budgeting, accountability, income generation (SM 1.25; IMAS 3.12; RP 4.26; RU 4.44)

Commonwealth Science Council (1982)
National and regional research and development institutes including:
1. Kenya Industrial Research and Development Institute (KIRDI)
2. Malawi Bureau of Standards
3. Federal Institute of Industrial Research, Nigeria
4. The Mauritius Sugar Industry Research Institute (MISRI)
5. National Research Council, Uganda
6. The Institute of Mining Research, Zimbabwe

1. Policy formulation and role clarification for research institutions (SM 1.1)
2. Management and coordination improvements (SM 1.1-1.4; ClAs, IMAS)
3. Improvements in funding and external support (SM 1.25)
4. Improvements in the quality of research (ROPs 4.1-4.5)
5. Human and institutional development of research managers, scientists, industrialists and policy-makers (SM 1.16-1.4; IMAS 3.14)
6. Promotion of extension, demonstrations, exhibitions, etc. (RU 4.42)
7. Promotion of R&D to support local industries (RU 4.44)
8. Regional collaboration (SM 1.2; ClAs 2.1)

Key issues for institutional development:
All the dimensions were matched with the model. However, a few of them were so ambiguous that they could not be identified with a single dimension. For example, the statement that the institution suffers from a 'weak institutional scientific value system' may be related to weaknesses in strategic management (SM) or research operations (ROps).

The results of Table 2 indicate that the literature on management of research institutions in developing countries identifies aspects of strategic management (SM) much more frequently than other institutional dimensions. Collaborative institutional arrangements (CIAs), on the other hand, are the least frequently discussed (see Table 3 below).

### Table 3. Summary frequency counts of elements of institutional dimensions from five evaluation studies

<table>
<thead>
<tr>
<th>Evaluation studies</th>
<th>1. Institutional autonomy (SM 1.16, 1.36)</th>
<th>2. Strategic leadership (SM 1.1)</th>
<th>3. Internal management and administration (IMAS)</th>
<th>4. Commercial and client orientation (SM 1.22; RU 4.44)</th>
<th>5. Building an internal sustainable technical capability (IMAS 3.11-3.15)</th>
<th>6. Developing, motivating and retaining staff (SM 1.32, 1.41; IMAS 3.14)</th>
<th>7. Developing appropriate corporate culture and value system (SM 1.12; 1.45)</th>
<th>8. Collaboration with key external institutions (CIAs 2.1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black (1980)</td>
<td>Various research institutions from developing countries including:</td>
<td>1. Need to establish credibility with industry (SM 1.22; RP 4.26; RU 4.44)</td>
<td>2. Need to manage the external political, social and cultural environment (SM 1.2)</td>
<td>3. Effective strategic leadership with locally grounded and clear corporate goals and mission (SM 1.1)</td>
<td>4. Avoiding spreading institutional resources too thin or over specialization (SM 1.13-1.16; ROPs 4.1)</td>
<td>5. Proper staffing, especially for critical positions such as the CEO and other junior management positions (SM 1.32)</td>
<td>6. The need for the development of mutually beneficial strategic alliances and joint ventures with multinational corporations and other organizations, both local and foreign (CIAs 2.1; SM 1.26; RU 4.44)</td>
<td></td>
</tr>
<tr>
<td>Institutional dimensions/elements</td>
<td>AAU</td>
<td>NSTC</td>
<td>RCRD</td>
<td>RCESR</td>
<td>NCESR</td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------</td>
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<tr>
<td><strong>a) Strategic Management (SM)</strong></td>
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<td>-</td>
<td>5</td>
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<td>1</td>
<td>2</td>
<td>2</td>
<td>7</td>
<td>13</td>
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<tr>
<td>3. Resource acquisition/ utilization</td>
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<td>2</td>
<td>-</td>
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<td>1</td>
<td>6</td>
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<td>4. Internal leadership</td>
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<td>6</td>
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<td><strong>b) Collaborative arrangements (CA)</strong></td>
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<td>3</td>
<td>1</td>
<td>2</td>
<td>12</td>
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<td><strong>c) Management and administration (MA)</strong></td>
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<tr>
<td>1. Library/documentation/information</td>
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<td>-</td>
<td>-</td>
<td>-</td>
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<td>2. Research equipment infrastructure</td>
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<td>2</td>
<td>-</td>
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<td></td>
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<td>3. Finance and administration</td>
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<td>4</td>
<td>4</td>
<td>-</td>
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<td>4. Human resource management</td>
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<td>4</td>
<td>19</td>
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<td>5. Marketing and public relations</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>Subtotal</td>
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<td>12</td>
<td>1</td>
<td>10</td>
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<td><strong>d) Research operations</strong></td>
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<td></td>
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<td>1. Research topics</td>
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<td>1</td>
<td>1</td>
<td>2</td>
<td>8</td>
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<td></td>
</tr>
<tr>
<td>2. Research production</td>
<td>-</td>
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<td>4</td>
<td>2</td>
<td>1</td>
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<tr>
<td>3. Research dissemination</td>
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<td>2</td>
<td>-</td>
<td>-</td>
<td>4</td>
<td>7</td>
<td></td>
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<tr>
<td>4. Research utilization</td>
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<td>5</td>
<td>7</td>
<td>-</td>
<td>-</td>
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<td></td>
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<td>5. Research feedback</td>
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<td>3</td>
<td>7</td>
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<td><strong>Total</strong></td>
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<td>25</td>
<td>33</td>
<td>11</td>
<td>40</td>
<td>132</td>
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</tbody>
</table>

AAU, African Agricultural University; NSTC, National Science and Technology Commission; RCRD, Research Centre for Rural Development; RCESR, Regional Council for Economic and Social Research; NCESR, National Centre for Economic and Social Research.
Nos. 1 and 2 are from Anglophone Africa; 3 from South America; 4 from continental Africa; and 5 from Francophone Africa. Institutional names have been disguised.

Evaluation studies

Each of the evaluation studies provided a list of important issues, concerns or recommendations for the particular research institution studied. These issues were analyzed using the dimensions and sub-dimensions of the model, and the results are presented in Table 4. Although the names of the institutions have been disguised, the data relate to real active research institutions operating in different developing countries.

As with the literature review studies, all the issues identified from the evaluation studies were successfully classified according to the dimensions and sub-dimensions of the model. However, unlike the literature review studies, the evaluation studies have a more even distribution of frequency counts among the four dimensions. Specifically, about 30 per cent of the frequency counts were for each of strategic management (SM), internal management, administration and supervision (IMAS) and research operations (ROPs). Interestingly, as with the literature review studies, collaborative institutional arrangements (CIAs) received least attention by way of frequency counts (see Table 4 below).

Table 4. Percentage frequency distributions of institutional dimensions for the two research methods

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Selected studies (%)</th>
<th>Evaluation studies (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Strategic management (SM)</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>2. Research operations (ROPs)</td>
<td>28</td>
<td>29</td>
</tr>
<tr>
<td>3. Internal management administration and supervision (IMAS)</td>
<td>14</td>
<td>31</td>
</tr>
<tr>
<td>4. Collaborative institutional arrangements (CIAs)</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>100 %</td>
<td>100 %</td>
</tr>
</tbody>
</table>

Note: Based on the analysis of ten selected studies (see Table 2) and five evaluation studies (above).

DISCUSSION

The purpose of this article was the development and testing of a theoretically grounded model of institutional analysis and development for research institutions in developing countries. The results of the analysis of the literature review and evaluation studies of specific institutions support the existence of these dimensions and sub-dimensions. This is particularly so for the three most frequently identified dimensions of strategic management (SM), research operations (ROPs) and internal management, administration and supervision (IMAS). Collaborative institutional arrangements (CIAs) should be part of SM or ROPs, as Kiggundu’s (1989) conceptualization seems to indicate. More empirical and rigorous research is needed to resolve this question.

The data used in this study were not detailed enough to test for each of the sub-dimensions of the four institutional dimensions. Yet, from the literature, we know that some are given more attention than others. For example, within IMAS, marketing and public relations are given far less attention than human resource management or research equipment, infrastructure and physical plant. More research is needed to determine the completeness of the model, the relative importance of the various dimensions and sub-dimensions and the determination of the required skills, knowledge and abilities to perform the associated tasks in a developing country context. For example, we know almost nothing about the required leadership attributes for heading a research institute in a developing country or the personal attributes or supervisory requirements for researchers, scientists, or engineers operating within a developing country environment.
Table 5. Framework for analyzing research institutions

<table>
<thead>
<tr>
<th>Institutional tasks</th>
<th>Significance to institution</th>
<th>Level of performance</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not at all significant</td>
<td>Poor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moderately significant (sig.)</td>
<td>Fair</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Very significant (excellent)</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Very good</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Excellent</td>
<td></td>
</tr>
<tr>
<td>Strategic management</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1. Institutional leadership</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. External Interfacing</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. Resource acquisition /utilization</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. Internal leadership</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Collaborative arrangements</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. Strategic collaborative</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6. Operational collaborations</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Management and administration</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7. Library documentation/ information</td>
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</tr>
<tr>
<td>8. Research equipment/ infrastructure</td>
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<td>9. Finance and administration</td>
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<tr>
<td>10. Human resource management</td>
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</tr>
<tr>
<td>11. Marketing and public relation</td>
<td>2</td>
<td>3</td>
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<tr>
<td>Research operations</td>
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<tr>
<td>12. Research topics</td>
<td>2</td>
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<tr>
<td>13. Research production</td>
<td>2</td>
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<tr>
<td>14. Research dissemination</td>
<td>2</td>
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<td>4</td>
</tr>
<tr>
<td>15. Research utilization</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>16. Research feedback</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

The literature points to the importance of strategic management, and to the critical leadership roles the chief executive officers (CEOs) play in the institutional development of their research institutions. For example, Easter et al. (1989), in a longitudinal study of India’s state of agricultural universities, observed that the strong leadership provided by the first vice-chancellors of these universities contributed significantly to their institutional building and development. Yet we know so little about the men and women who, for the last 30 years or so, have been at the strategic apex of research institutions in developing countries. Time is running out for capturing their personal accounts and insights of the requirements for the effective leadership and management of research institutions within their developing contexts.

In the past, most approaches to understanding and changing organizations in developing countries have tended to be general, using only generic concepts from management and organization theory (Blunt, 1990). The assumption behind these efforts is that the same strategies would be appropriate for different types of organizations, with different corporate missions, and operating under different task conditions and resource constraints. While these approaches provide useful general concepts for advancing development management theory, they are not specific enough to deal with the unique aspects of certain types of organizations such as research institutions. In this paper, an attempt has been made to show the benefits of going beyond the general concepts for a more complete understanding of highly specialized organizations in developing countries. It may well be the case that one of the reasons why development management has had only limited impact on the structuring and managing of organizations in developing countries is because it operates at a highly general level of abstraction and leaves many contingencies unidentified and unspecified. This type of research is therefore needed to begin to discover different areas of convergence and divergence for different types of organizations operating in different developing countries.
While suggesting new directions for future research, the limitations of the present study must be noted. Firstly, the study used only secondary sources of data. Secondly, in analyzing the studies, only frequency counts of each dimension and sub-dimension were used. No attempts were made to assess the impact of these dimensions individually or in groups on the management and development of research institutions in developing countries. Finally, the coding of the dimensions and sub-dimensions was done by the author with no opportunity for testing of inter-rater reliability.

CONCLUSION

In spite of their potential contribution to human development, research institutions in developing countries have received very little attention as objects of management study. This study has attempted to fill this void. In addition, it has come to the conclusion that recognizing the existence of the institutional dimensions - SM, IMAS, ROPs, CIAs - and managing relationships and interdependencies among them such that they all act synergistically towards a common corporate mission within a scientifically driven value system, mindful of the realities of a developing society, is what differentiates effective from ineffective research institutions.

The model developed and tested here can be used for a variety of purposes. It is expected that it will stimulate research for advancing the theory and practice of the management and development of research institutions and subsystems thereof operating in developing countries. It can also be used for a preliminary diagnosis of the institutional capacity of a research institution to determine its absorptive capacity for new projects, programs or mandates. Information on the relative strengths or weaknesses of various dimensions and sub-dimensions can be used for project design and as a basis for negotiations with various stakeholders.

Table 5 provides a possible framework for obtaining such information by assessing the significance and current level of performance of different institutional dimensions. This information can also be used for inter-institutional analysis and comparisons for the purposes of developing institutional networking and collaborative institutional arrangements both at home and abroad.

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