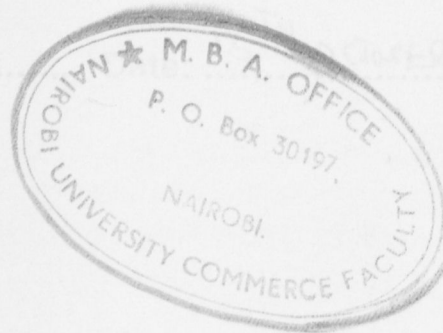# ISSUES IN STRATEGY FORMULATION AND IMPLEMENTATION IN INTERNATIONAL COLLABORATIVE RESEARCH AND DEVELOPMENT: A CASE STUDY OF RESEARCH BASED INSTITUTIONS IN KENYA
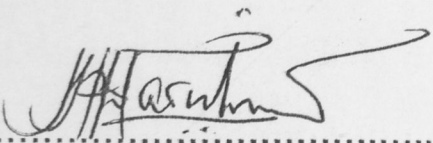
By

WARUHIU, HENRY K.

A Management Research Project Report Submitted In Partial
Fulfilment of the Requirements for the Award of
Master of Business Administration,
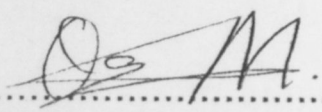Faculty of Commerce, University of Nairobi

October 2004

DECLARATION

This project is my original work and has not been submitted for a degree in any other University.

Signed: .... Date: 15ᵀᴴ OCTOBER 2004

Waruhiu, Henry K.

This project has been submitted for examination with my approval as the University Supervisor.

Signed: .... Date: 25/11/2004

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DEDICATION

To my late father Nahashon who always inspired me to learn;
To my mother Zelipah for her perseverance during my studies;
To my wife Jane for her understanding and being always there for me.

ACKNOWLEDGEMENTS

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Abstract

Using a sample of twenty research-based institutions within which twenty-seven collaborative research settings participated in our study, we reveal that strategy formulation and implementation in research-based institutions in Kenya is characterized by scarce local talent in collaboration management. We also show that foreign collaborators dominate strategy formulation and implementation in these settings, ($R^2_a=0.996$), and that collaboration in international R&D advances foreign policy objectives. Using the non-cooperative model, we find that dominated strategy reduces with the duration of strategic plans put in place. We contend that realized strategy in international collaborative R&D is primarily explained by emergent components rather than planned components of strategy. One implication of our findings is that a national policy on R&D needs to be put in place. Another implication is that local researchers need to take a more proactive role in determining the local research agenda.

Keywords: Strategy formulation and implementation, research and development, non-cooperative game.

CHAPTER ONE

INTRODUCTION

1.1 Background

In 1952, John Kenneth Galbraith noted that the 'era of cheap innovation' was over. He claimed that firms had exhausted low-cost Research and Development (R&D) programs and were now forced to pool their R&D efforts in order to achieve scientific progress as well as gain and retain market power. This seems to have triggered off the need for international collaborative R&D. Despite this development, antitrust law hampered firms' collaboration in the R&D process until the mid-eighties.

Since mid 1980s, there has been a proliferation of international collaborative research and development settings in many developing countries. The emergence of these is attributed to, *inter alia*, market failure of institutions, rapid changes in the external environment occasioned by technological advancements and the imbalance between demand and supply of research funding in organizations as well as stunted market growth in developed countries. Many research-based institutions saw the remedy to market failure of institutions, demand and supply imbalance in technology and knowledge as being addressed through collaborative research. This would offer better opportunities for attracting research funding (Ross, 1986).

In Kenya, many public research-based institutions (particularly parastatal organizations) have entered into collaborative research arrangements with foreign institutions in the last two decades. These include, the Kenya Medical Research Institute (KEMRI), Kenya Agricultural Research Institute (KARI) and Kenya Industrial Research Institute (KIRDI) among others. A number of international research bodies have also come into being. These include the International Livestock Research Institute (ILRI), International Centre for Research in Agroforestry (ICRAF) and International Centre of Insect Physiology and Ecology (ICIPE). The collaborative research arrangements were organized as collaborative research centers.

Micro-economists begun to develop theoretical frameworks describing R&D co-operation in the mid-eighties. König *et al*, (1994) observe that while only 10% of all

manufacturing firms in Germany were involved in R&D co-operations in 1971, 20 years later, almost half of all the firms in manufacturing industries conducted co-operative research. This points towards the growing importance of collaborative research.

In the 1990s, focus shifted towards sustainability of development programmes (The Local Agenda 21 Planning Guide, 1996:6). This compelled the research-based institutions to begin aligning their research agenda to the new global development dispensation. In 1996, following the Copenhagen World Summit for Social Development (WSSD) held in 1995 (World Summit for Social Development Proceedings, 1996:12), there emerged the need to integrate these institutions into development agenda given the vital socio-economic role they were playing. This meant that the initiatives that had been started as mere spin-offs of government failure to chart new ways for institutional renewal required to be institutionalised within the host institutions. This was particularly important because these para-institutions were receiving large financial support from the donors and collaborators. Several factors needed to be taken into account then, but this was not done. The Memorandum of Understanding (MoUs), which had been put in place in the 1980's to guide the R&D processes needed to be reviewed. More institutionalised frameworks required to be put in place, and the collaborative atmosphere in which the spirit of partnership had been initiated clearly defined. Equally, as this marked the beginning of institutions within institutions, legal frameworks, issues regarding governance, structure and systems needed to be put in place. Long-term strategies required to be crafted. Such strategies ought to have been aimed at, *inter alia*, the role of the collaborators and partners, the resources that were to be shared, operational frameworks and so on. This was particularly important since the R&D set-ups continued to record very attractive growth despite the poor performance in the general economy.

In the 1990s, major corporations in the world begun to undertake business process reengineering (Hammer and Champy, 1994). Technological advancements, globalization and the presence of ever more demanding customers characterized these years. Strategic Business Units (SBUs) flourished (Pearce and Robinson, 2000).

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While the collaborative centres ought to have crafted strategies as SBUs, there is little evidence that they did. There also exists little documentation on how the centres in Kenya evolved, developed their strategy or even implemented it. Information and resource asymmetries were, and continue to be, evident between North and South collaborating R&D parties, with the North being favoured (Cassiman and Veugelers, 2002; De Bondt and Henriques, 1995).

Pioneering contributions on R&D investment with spillovers include Brander and Spencer (1983), Katz (1986) and Spence (1986). D'Apremont and Jacquemin (1988, 1990) have developed a two-stage Cournot duopoly game for R&D expenditures and product market competition. Kamien *et al,* (1992) have introduced oligopoly markets and also allow the degree of product substitution to vary between perfect complements and perfect substitutes. These are important sources from which this study drew. The study takes into account research spillovers, which arise whenever knowledge produced by one firm is voluntarily or involuntarily given to some other firm without that firm having paid for it. Contemporary literature suggests that issues of structure, systems and managerial competence have just begun to be addressed in these settings. The study took these factors into account.

With increased globalization, the importance of collaboration has gone up. Specifically, the need to collaborate in research and development has gained currency. It is strikingly remarkable that as this study was going on, a leading Kenyan scholar based at the Kennedy School of Government, Harvard conducted a series of public lectures, articulating the need for Kenya to define one of its strategic options as research and development. It is also notable that at the time this report was being completed, a motion urging the government to establish a research fund received overwhelming support in parliament (Daily Nation, Thursday, October 14, 2004). It against such background that this study is deemed timely and important.

This study was based on the premise that strategy formulation and implementation in international collaborative R&D has been understudied. The study was centred on the importance of undertaking research to enhance learning through international collaborative R&D work, improving the quality of strategy formulation and enhancing overall institutional performance.

1.2   The Research Problem

Collaborative R&D structures as they presently exist are neither entirely separate and legal entities on their own, nor totally answerable to one parent. Answering to two parents whose visions might be totally different not only suggests that there is role duality and greater ambiguity in decision-making, but also that it is a panacea for sub-optimal performance. Role duality and sub-optimality gives birth to a hybrid strategy that, in a non-cooperative and non-linear pattern, strives for recognition and independence.   This is a misnomer, particularly when we consider that strategy formulation and execution requires cooperation and is dependent on several factors. These arrangements would tend to heighten political friction in international collaborative R&D settings.

Collaborative R&D is mainly a patent race (David and Keely, 2003; Hall and Ziedonis, 2000). The race is won on a non-cooperative game (Navaretti and Carraro, 1996). Strategy formulation and implementation on the other hand is a process that requires cooperation (Kotter, 1996; Katzenbach et al, 1996; Burnes, 2000). In collaborative R&D, information and resource asymmetries, coupled with the need to gain reputation as a competitive edge creates numerous hurdles to effective strategy formulation and implementation.

While effective strategy formulation and implementation requires people in the organization to have a shared vision and shared values, research and development tends to be guided by rights which have to be protected – intellectual property rights, copyrights and patent rights. One of the fundamental questions that arise then is how strategy formulation and implementation takes place in a research and development environment, given these two extreme schools of thought.

Studies have shown that R&D capacity is critical even for national competitive advantage (Porter, 1990). In Kenya, it is not clear how lack of incentives impact on R&D capacity and capability – a trend that is similar in most developing countries.

Although there have been previous studies that have dwelt on strategy amongst Kenyan organizations (Aosa, 1992; Kiruthi, 2001; Kiliko, 2000; Ndiao, 2001; Koyio, 1999), no studies have focused on the collaborative research and development centres which, markedly, are predisposed to different characteristics given the very unique nature of most research and development initiatives.

Little empirical research exists on the impact of asymmetric spillovers on the incentives to cooperate in R&D (De Bondt and Henriques, 1995). Kaiser (2001) further observes that empirical evidence on the determinants of research joint venture formation and on the effects of these research cooperations on research efforts is scarce. There is also little that is known on complementarities and relationships among firms and other institutions engaged in R&D, yet existing literature suggests that research facilitates innovation (Peters, 1997; Porter, 1980), which in turn is a key component of a firm's competitiveness. Empirical studies on the relationship between spillovers and cooperative R&D behaviour are virtually non-existent (Veugelers and Cassiman, 1999). The studies cited above suggest that there is a link between R&D, innovation and a firm's competitiveness. This leads us to deduce that since strategy is geared towards enhancing an organization's competitiveness, there is a link between strategy formulation and implementation and R&D.

While the game theoretical literature suggests a positive relationship between R&D cooperation and R&D intensity, the empirical evidence is mixed (Birkler et al, 1997). Contemporary literature yields mixed signals regarding whether or not R&D intensity is a predictor to collaboration (Belderbos, 2003; Cui et al, 2002; Sampson, 2002). This indicates there is need for more studies in collaborative R&D.

Scarce empirical evidence on the prevalence of motives for co-operation suggests that exploiting complementarities is a major motive for co-operation in R&D. Studies by Mariti and Smiley (1983) and Hagedoorn and Schakenraad (1991) seem to suggest that complementarity in technology is reported as a major motive, while sharing costs and risks are only of minor importance, and transfer of technological know-how of average importance. More work is needed to study the specificities that

allow for more profitable and stable cooperation and aspects of strategy formulation and implementation adopted by research based institutions in Kenya.

This study therefore attempted to answer three fundamental questions.

(i) What are the characteristics of strategy formulation and implementation undertaken in international collaborative R&D settings within research based institutions in Kenya?

(ii) What aspects of strategy formulation and implementation do local personnel play a role in?

(iii) What affects their participation in this process?

1.3 Study Objectives

The research objectives for this study were:-

(i) To establish the features of strategy formulation and implementation undertaken by international collaborative R&D settings within research based institutions in Kenya.

(ii) To examine what aspects of strategy formulation and implementation process the local personnel play a role in.

(iii) To determine the factors that influence participation of the local personnel in the strategy formulation and implementation process.

1.4 Hypotheses

Arising from these objectives, the researcher aimed at testing the following hypotheses:-

Hypothesis One (H1): Collaborative R&D settings in Kenya lack a clear strategy on what their future direction is or will be. This tends to increase the level of friction within these settings.

Hypothesis Two (H2): International collaborative R&D settings in Kenya are driven by dominated strategy from their partners from developed countries.

Hypothesis Three (H3): Non-cooperative game in international collaborative R&D deters the strategy process, thereby leading to reductionist behaviour in the R&D settings in Kenya.

Hypothesis Four (H4): When negotiating collaborative R&D, managers often overlook the structure of collaboration or 'collaboration governance'. Since strategy follows structure, flaws in structure lead to poor strategy formulation and implementation.

Hypothesis Five (H5): Realized strategy in collaborative R&D settings is primarily explained by emergent components of strategy rather than planned components.

Hypothesis Six (H6): Strategy implementation in international collaborative R&D settings in Kenya is principally a 'muddling through' process.

These hypotheses were in line with the study objectives.

- H1, H3, H5 and H6 relate to objective one in the study.
- H2 relates to objective three.
- H4 and H5 relate to objective two of the study.

1.5   Importance of the Study

Coordination costs are high in international collaborative R&D (Veugelers, 1997). The findings from this study will be seminal in suggesting approaches for reducing coordination costs for collaborative R&D.

The results from the study will be important to the managers, local and foreign researchers of the collaborative R&D centres who are interested in improving the overall performance of the organizations they work for.

The results from this study will provide useful material for academic colleagues who may have an interest in gaining more insights on international collaborative R&D frameworks. It will also be useful to public policy makers by enlightening them on the factors to consider in approving and improving collaborative R&D work.

The study sheds some light on pertinent issues regarding internationalization of R&D in Kenya. The findings have implications on the management of international collaborative R&D, researchers, policy makers as well as donors and the government, particularly because R&D has for long been associated with the institutional innovation process and firm's competitive thrust.

This study extends the work of Aosa (1992) to a relatively new field of collaborative R&D frameworks. It however differs from Aosa's work in that it addresses aspects of participation of local personnel and whether donor funding is dependent on the presence of expatriate staff.

This study differs from previous works on strategy formulation and implementation in several ways. It takes into account synergistic forces of collaboration rather than competition; it uses the non-cooperative model for collaborative R&D and it draws from a wider cross-section of R&D settings. Unlike the works by Kiliko (2000), Kiruthi (2001) and Ndiao (2001), the researcher used multiple regression and tested hypothesis in analysing the data obtained from the questionnaires.

CHAPTER TWO

LITERATURE REVIEW

This chapter outlines the relationship between strategy and collaborative R&D; the benefits of collaborative R&D; its shortcomings and asymmetries; the characteristics of strategy formulation and implementation in international collaborative R&D; pertinent aspects of strategy formulation and implementation as well as factors that support effective strategy formulation and implementation. Towards the end of the chapter, collaboration formation games are discussed and the models used in the study presented.

2.1 Characteristics of strategy formulation and implementation in international collaborative R&D

Firms increasingly collaborate in R&D in response to the increasing pace of technological development and rising costs of new product development (Veugelers, 1997). Collaborative ventures are frequently the brainchild of senior executives who, after negotiating what capabilities each firm brings to the collaboration, leave further details un-addressed (Ross, 1986). This seems to suggest that strategic analysis in collaborative R&D is not given the emphasis it deserves.

The outcomes of many international collaborative R&D programs have been, at best, rather mixed (Birkler, *et al*, 1997). Attaining many, if not most, of the potential economic, operational and political benefits that theoretically should flow from collaborative R&D programs has proven difficult. Most collaborative R&D programs have not led to an economically rational division of work, tasks or R&D assets. Also, many collaborative R&D programs have caused severe political friction among participating organizations (Sampson, 2002).

Strategy is about industry leadership and competitive superiority. This requires learning; a factor that causes R&D institutions to collaborate (Qureshi, *et al*, 2002). Cohen and Levinthal (1989) put forward arguments why industry leaders may learn

more from followers in their work on absorptive capacity (they held that leaders have built up a larger know-how base, which serves to efficiently absorb). However, there are also arguments that followers may learn more from leaders since they are far from diminishing returns to knowledge creation (Sampson, 2002; Cohen and Levinthal, 1989; Kogut, 1998).

There is little evidence pointing towards the optimal level of learning in the case of both the leaders and followers. This may be partly due to the fact that even in the evolving knowledge management literature, the debate between tacit and explicit knowledge still rages on. Clearly, there are difficulties in making tacit knowledge explicit (Waruhiu et al, 2003). Knowledge creation and destruction strategies in international collaborative R&D, among other settings, are yet to be understood more clearly. It is instructive that what entails international collaborative R&D leadership and how it is achieved are areas that evoke research interest.

In examining what leads to collaboration in R&D, Kleinknecht and Reijnen (1992) found that the use of various types of government facilities, such as credits and subsidies for R&D works, seems to increase the probability that firms cooperate in R&D. The stock of knowledge; reputational capital; human capital and the firm's image; ability to create new products or enter new markets as well as the flexibility in adopting new technological opportunities are all competences acquired through collaboration with other domestic and foreign organizations (Bayona, et al, 2001). These impact positively on the firm's competitive advantage. They motivate the firm to replicate collaborative and innovative strategies over time.

One of the main questions in research collaboration formation is whether collaborative R&D increases or decreases R&D efforts. This depends on the relation of the level of spillovers to a term usually consisting of product substitutability and market demand. Research spillovers arise whenever knowledge produced by one firm (i) is voluntarily or involuntarily given to some other firm (j) without firm j having paid for it. If spillovers are sufficiently large, R&D investment under collaboration exceeds that of competition (Cassiman and Veugelers, 2002).

Strategy formulation and implementation in international collaborative R&D is characterized by weak and inadequate environmental scanning, partial knowledge of strategic capability, little attention to organizational vision, mission and shared values and inadequate attention to strategic choice (Belderbos, 2003). There are suggestions that even though these settings have a wealth of intangible assets, most emphasis is given to tangible assets. This reduces the strength of their distinctive advantage (Cassiman and Veugelers, 2002). This suggests that decisions on resource configuration, organizational structure and systems, values, processes, array of products and services offered, stakeholders interests to be met as well as the skills required to position the organizations strategically in the market are grossly compromised. Notably, these are important parameters in strategy formulation and implementation.

2.2   Aspects of Strategy Formulation and Implementation

Strategic management is a process in the sense that strategies are the outcomes of careful objective analyses and planning (Lynch, 2000). Corporate, functional and tactical strategies have the potential of moving the organization to strategic leadership. The aspects of strategy formulation and implementation are contained in the model presented in Figure 1 below.

Strategy Formulation

Strategy Implementation

Identification of opportunity and risk.

Organizational structure and relationships.
- Division of labour.
- Coordination of divided responsibility.
- Information system.

CORPORATE STRATEGY

Determining material, technical, financial and managerial resources

Patterns of

purposes and

policies

defining the

organization

and

its business

Organizational processes and behaviour.
- Standards and measurement.
- Motivation and incentive systems
- Recruitment and development of managers.

Personal values and aspirations of senior managers

Acknowledgement of corporate social responsibility

Top Leadership
- Strategic Level
- Organizational Level
- Personal Level

Figure 1: Strategy Formulation and Implementation Model

Source: The Strategy Process, Concepts, Contexts, Cases, 3rd Edition, Mintzberg and Quinn (1996), Pg 50.

This model recognizes strategy formulation and implementation as a process. This is important since a change in one or more components affects several or all of other

components involved in the process. As Mintzberg and Quinn (1996) observed, this model provides for the sequential nature of strategy formulation and implementation.

Whereas the strategy process requires a cooperative game to a very large extent, collaborative R&D is principally based on non-cooperative games (Navaretti and Carraro, 1996).

2.3   Levels of strategy

Strategy in an organization is viewed from three levels: corporate, business and functional. The characteristics of strategic management decisions vary with the level of strategic activity considered (Pearce and Robinson, 2000).

At the corporate level, there are members of the board of directors and the chief executive and administrative officers. Decisions at corporate level tend to be more value oriented, more conceptual, and less concrete than decisions at the business or functional level (Pearce and Robinson, 2000). Corporate level decisions are often characterized by greater risk, cost and profit potential; greater need for flexibility; and longer time horizons (Mintzberg and Quinn, 1996). Such decisions include the choice of businesses, dividend policies, sources of long-term financing and priorities for growth. At that level, strategic management entails assessing strategic capability of the organization.

The second rung of decision-making is business level, composed principally of business and corporate managers. Business-level decisions help bridge decisions at the corporate and functional levels. Functional level decisions implement the overall strategy formulated at the corporate and business levels. Functional level decisions incur only modest costs, because they are dependent on available resources (Lynch, 2000; Pearce and Robinson, 2000). The ideal strategic management process is developed and governed by a strategic management team. The strategic management team includes decision makers from the three levels of corporate, business and functional (Mintzberg and Quinn, 1996).

Strategic management involves three broad considerations: Strategic analysis; strategic choice and strategy implementation (Lynch, 2000; Pearce and Robinson 2000).

2.4 Strategic Analysis

In undertaking strategic analysis, the strategist seeks to understand the strategic position of the organization. Strategic analysis assesses the nature of the environment; takes an audit of environmental influences; identifies key competitive forces; the organization's competitive position as well as key opportunities and threats using techniques such as the SWOT, PEST, Value Chain (VC) analysis as well as Michael Porter's Five Forces model (Pearce and Robinson, 2000; Porter, 1980). The organization then chooses its strategic position.

Strategic management entails assessing strategic capability of the organization, which is assessed by analyzing the internal environment (which attempts to explain the internal strengths and weaknesses). Analyzing the tangible and intangible resources an organization has as well as the distinctiveness of those resources may yield fruitful insights on areas that an organization can achieve competitive advantage over its competitors (Lynch, 2000). The organization can also tap into its core competences through analysis of activities, know-how and skills (Ansoff and McDonnel, 1990). This may provide advantages for that organization which others find difficult to imitate. The resources resident within the organization, the competence with which the activities of the organization are undertaken and the balance of resources, activities and business units in the organization then help explain strategy as a fit between organizational capacity and environmental demands (Mintzberg and Quinn, 1996).

The organization should be wary of overall balance of resources, mix of activities undertaken and linkages between these two in order to avoid strategic drift (Ansoff and McDonnel, 1990). Organizational vision, mission, values and objectives play a key role in defining the purpose of the organization (Pearce and Robinson, 2000).

2.5   Strategic Choice

In many ways, strategic choice is the core of strategic management (Bowman and Helfat, 2000). As some authors have previously observed, strategy develops in quicks and starts, creating many dilemmas amongst which the strategists must make their choices (Hirschhorn, 2002; Pettigrew, 1988). In making strategic choices, the strategists make their decisions based on past information as well as the insight on the future direction of the organization.

Strategic choice includes identifying bases of strategic choice and generation of strategic options that determine the strategic direction. The bases arise from an understanding of stakeholder expectations and influence (Johnson and Scholes, 1997). There are also bases of strategic choice in terms of how the organization seeks to compete at the strategic business unit (SBU) level. Other factors included are the methods of strategic development; evaluation and selection of strategic options (assessing the suitability of strategy); evaluating the strategic fit between the resource capability of the organization and its environment and assessing the feasibility and the acceptability of selected options to the stakeholders (Pearce and Robinson, 2000).

2.6   Strategy Implementation

Once the analysis and choices have been made, strategy must be implemented. This deals with the translation of strategy into action. Strategic implementation requires a good strategic architecture of the organization and should thus take into account how the various parts of the organization work together in a manner that optimizes resource utilization (Johnson and Scholes, 1997).

Strategy implementation includes considerations of who will be responsible for strategy implementation; the most suitable organizational structure that would support the implementation of strategy (Pettigrew, 1988; Carnall, 1997; Lynch, 2000); the need to adapt the systems used to manage the organization (Johnson and Scholes, 2000); the key tasks to be carried out and desirable changes in the

resource mix of the organization as well as the mandate of each department in the organization and the information systems to be put in place to monitor progress and resource planning (Pearce and Robinson, 2000). Implementation may also take into account the need for retraining the workforce and management of change (Johnson and Scholes, 1997).

Strategic analysis, choice and implementation comprises of nine tasks. These are formulating the company's mission, including broad statements about its purpose, philosophy and goals; developing a company profile that reflects its internal conditions and capabilities; assessing the company's external environment, including both the competitive and general contextual factors; analyzing the company's options by matching its resources with the external environment; identifying the most desirable options by evaluating each option in light of the company's mission; selecting a set of long-term objectives and grand strategies that will achieve the most desirable options; developing annual objectives and short-term strategies that are compatible with the selected set of long-term objectives and grand strategies; and implementing the strategic choices by means of budgeted resource allocations in which the matching of tasks, people, structures, technologies and reward systems is emphasised; and evaluating the success of the strategic process as an input for future decision making (Pearce and Robinson, 2000).

2.7   Support for Strategy

Strategy formulation and implementation can only be as successful as the systems put in place to support it are (Johnson and Scholes, 1997; Bowman and Helfat, 2000). Although there are numerous issues that go towards supporting strategy, this study focussed on cultural influences, governance as well as managerial styles and practices, seen in the lens of collaborative R&D. Since success in the strategy process requires leadership excellence (Carnall, 1997; Hamel and Prahalad, 1994), the study took leadership into account.

The importance of networking and collaboration, which is consistent with the systems approach (Haines, 2000), will continue to occupy the minds of all managers. The

emergence of organized collaborative R&D settings in Kenya is relatively new and little efforts have been made to look at these settings from a strategic management perspective.

International collaborative R&D requires learning new skills (Kolb, 1984), capabilities technology (Cassiman and Veugelers, 2002; Kogut, 1998) or information in one market and then transferring them within a wide geographical location (Barlett and Ghoshal, 1998). Although there have been numerous studies on organizational culture (Amit and Schoemaker, 1998; Miller and Rice, 1967; Mintzberg, 1983; Handy, 1989) mainly drawn from behavioural schools, cultural influences on collaborative R&D have been largely ignored (Weeks and Galunic, 2000).

Collaborative R&D settings have fallen victims of governance myopia yet numerous studies suggest a strong relationship between good corporate governance, strategy formulation and execution. Tuschuke and Sanders, (2003); Amihud and Lev, (1981); Fama and Jensen, (1983); Murphy, (1999); Shleifer and Vishny, (1997) have all alluded to this relationship. Collaborative R&D has been instrumental on the internationalization and globalization of knowledge. Barlett and Ghoshal, (2001); Rugman, (2001); Peterson *et al,* (2001); O'Sullivan, (2000) and Yusuf (2001) have suggested that governance issues are increasingly important in this globalization era. This study probed some of the governance issues that are pertinent in collaborative R&D settings.

2.8   Collaboration Formation Games

Previous studies on collaboration have suggested many motives for the formation of collaboration. These include the creation of internal strengths, risk sharing and uncertainty reduction (Harrigan, 1985, 1986; Pfeffer, 1972; Pfeffer and Nowak, 1976; Pfeffer and Salancik, 1978). Collaborative strategies have the ability to influence market entry and exit for new players as well as the technological capabilities in the supply chain (Wilson, 1975). Collaborative strategies facilitate structural change because they enable firms expand or contract productive capacities (Belderbos, 2003).

This study advanced the argument that R&D collaboration is based on a number of 'games'. The games include the non-cooperative game (Navaretti and Cararo, 1996; Bloch, 1995; Ray and Vohra, 1999); the industrial organization game (Amit and Schoemaker, 1998; Miller and Rice, 1967; Mintzberg, 1983; Handy, 1989); the learning game (Senge, 1994; Argyris and Schon, 1978; Bateson, 1972; Tsang, 1997) and the resource-based game (Penrose, 1959; Rugman and Verbeke, 2000). These games are non-linear and unpredictable, but most importantly, they are very sensitive to and influence the internal and external environment of the collaborating firm. Thus, a sound strategy at the firm level is critical for the success of collaboration. In this study, the researcher was interested in the non-cooperative game. A model for this game is presented in Figure 2 below.

Figure 2: The Game Tree – Non-cooperative Model


```
                              M,S ──── Production ────▶ P⁰_m, P⁰_s
                          ▲          Duopoly
                         /
    Direct Production   /                                              Defection
                       /                                         ▶
                      /                                    P^d_m,c, P^d_,s,c
   P^d_m,c, P^d_,s,c  /                          S ── Production ──▶ S
                     /                               Monopoly
   Technology       /              R&D Co-operation
   Sharing         /          ▲                      Compliance
                  /          /                             ▶
                 /          /                         P*_m,c, P*_s,c
                ●          /
                 \        /
                  \      /                              P^d_m,n, P^d_s,n
   No R&D          \    /                          Defection
   Cooperation      \  /                       S ──▶ S
                     \/  S ── Production Monopoly
                                                   Compliance
                                                        ▶
                                                   P*_m,n, P*_s,n
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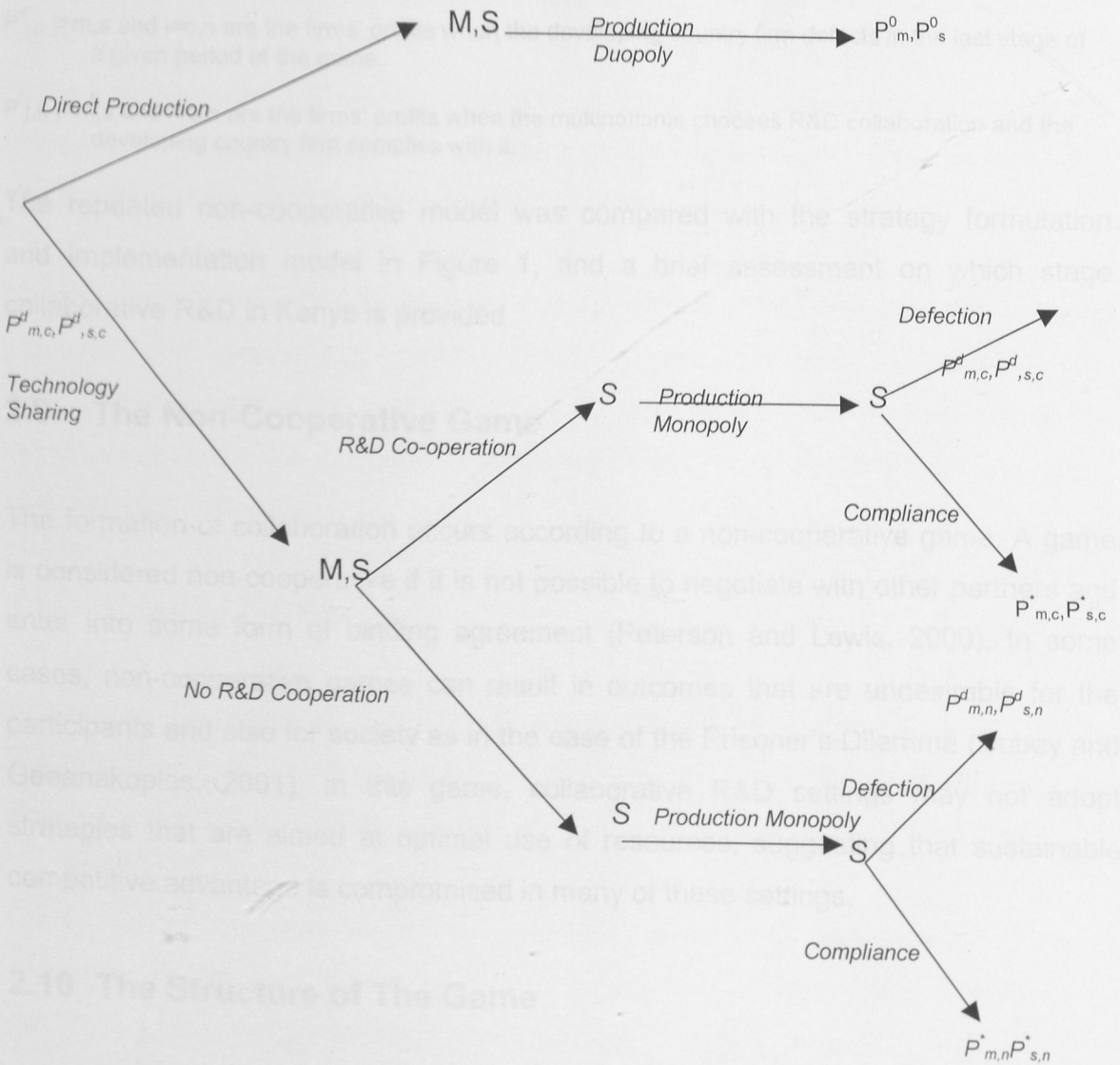
Source: From Learning to Partnership: Multinational Research and Development Cooperation In Developing Countries, Navaretti, G.B. and Carraro, C. (1996), World Bank.

Legend:

M =   Multinational (foreign) Firm.

S =   Developing Country Firm.

c =   The payoffs when the two firms co-operate on the development of a process innovation.

n =   The payoffs when the two firms carry out their own R&D non-cooperatively.

$P_{j,i}$, j=m,s and I=c,n are the duopoly Nash-cournot payoffs that the two firms achieve when the multinational firm decides to undertake R&D directly in the developing country.

$P^d_{j,i}$, j=m,s and i=c,n are the firms' profits when the developing country firm defects in the last stage of a given period of the game.

$P^*_{j,i}$, j=m,s and i=c,n are the firms' profits when the multinational chooses R&D collaboration and the developing country firm complies with it.

The repeated non-cooperative model was compared with the strategy formulation and implementation model in Figure 1, and a brief assessment on which stage collaborative R&D in Kenya is provided.

2.9   The Non-Cooperative Game

The formation of collaboration occurs according to a non-cooperative game. A game is considered non-cooperative if it is not possible to negotiate with other partners and enter into some form of binding agreement (Peterson and Lewis, 2000). In some cases, non-cooperative games can result in outcomes that are undesirable for the participants and also for society as in the case of the Prisoner's Dilemma (Dubey and Geaanakoplos, 2001). In this game, collaborative R&D settings may not adopt strategies that are aimed at optimal use of resources, suggesting that sustainable competitive advantage is compromised in many of these settings.

2.10   The Structure of The Game

The game looks at the case of foreign firms which carry out some R&D which is only related to its activities in the host market. In the host market, there is another competing firm, also carrying out some R&D. The foreign firm can choose between setting up a subsidiary and competing against the local firm (a duopoly) and establishing an arm-length agreement with the local firm and share monopoly profits. If they form the arm-length agreement the two firms can also decide to cooperate in R&D. In the duopoly, there is no cooperation in R&D (Navaretti and Carraro, 1996).

Amongst the scholars who have studied non-cooperative games of coalition formation are Bloch (1995) and Ray and Vohra (1999). The game provides a useful

framework for collaborative research work. Keely (2002) applies this type of game to a multi-period setting in which a distribution of coalitions is tracked.

Non-cooperative game allows for explicit analysis of how collaborations form and the strategies of research units. The structure of the non-cooperative game utilized is similar to that developed by Bloch (1995).

Navaretti and Carrato (1996) observed that the choice of R&D collaboration between industrial and developing countries (that is, between firms with asymmetric endowments of knowledge) is influenced by the intertemporal preferences of the developing country firm; the relative efficiency in R&D of the two firms and the extent of knowledge spillovers.

2.11 Rules of the Game

The interactions between the multinational and the developing country firm can be characterized as infinitely repeated game in which each period is divided into four stages (Navaretti and Carraro, 1996).

Stage one: The multinational firm decides whether to share the technology (knowledge) with the developing country firm or to undertake R&D directly in the developing country, by establishing a subsidiary.

In the first case, the agreement is characterised by a contract which specifies the share of profit that is taken by the foreign firm. This share can be viewed as a licence for the use of technology (knowledge) or as an equity share in a joint venture. If the two firms opt for a subsidiary, there are bilateral knowledge spillovers (each firm's R&D creates knowledge towards the other firm). These spillovers are asymmetric. The developing country receives spillovers larger than those received by the foreign firm.

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Stage Two: If the two firms have opted for the agreement, they decide whether or not to cooperate on the research and development of a process innovation which reduces the production costs of the developing country firm. The game assumes that innovation is market specific, implying that the R&D effort carried out by the two firms, either cooperatively or non-cooperatively, benefits the production process only of the developing country firm. This is not always the case. The foreign firm achieves an indirect benefit from its R&D effort through its share of profits from the agreement. R&D cooperation can occur only if the two firms opt for the agreement. If they do not, or if one of the two defects, market competition takes the form of a non-cooperative duopoly where non-cooperation concerns both output and R&D.

Stage Three: Production takes place. The developing country firm is a monopoly and remains so if the foreign firm chooses the agreement and becomes a duopoly if the foreign firm decides to undertake R&D directly in the developing country. Therefore, the multinational firm has an incentive to share the technology rather than to undertake R&D directly because the sum of duopoly profits is lower than the monopoly profit. However, when choosing the agreement, the foreign firm provides larger spillovers to the developing country firm, and also runs a risk of defection from the agreement. This risk does not exist in the duopoly case.

Stage Four: The developing country firm decides whether or not to comply with the agreement. If it chooses not to comply, it does not transfer to the foreign firm the agreed share of profits. When a developing country firm chooses to defect, the multinational firm reacts by producing directly in the developing country in the following period.

These four stages seem to suggest that in the non-cooperative game, there is conflict as well as cooperation between agents whose decisions are strategically interdependent. The Nash Equilibrium, which is a simple and powerful concept of strategic equilibrium attempts to explain this. It is a strategy profile that each player's strategy is the best given the strategies of other players in this strategy profile (Grygolec, 2003)[1]. The facts about Nash Equilibrium are that it is self-enforcing in normal form games; it exists always in normal form games; it may be inefficient; no

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[1] See 'Very Brief Notes on Game Theory, Internet download at www.econ.umn.edu

player will play dominated strategy and in many games there is multiplicity of Nash Equilibria.

To reach the Nash Equilibrium requires repeated games to weed off the cheaters in the R&D undertaking, but this seems only possible if we hold that there are no diminishing returns to learning. The other assumption we would hold is that increased collaboration increases the trust partners have for and towards each other.

An advantage of this game is that it allows for explicit analysis of how collaborations form and the strategies of research units. Economists have argued that many games do not have a dominated strategy in the non-cooperative games and that dominance is, in fact, the exception rather than the rule, (Peterson and Lewis, 2000). Dominated strategy is an alternative that yields a lower pay off than some other strategy.

2.12 Conceptual Frameworks

The Strategy formulation and implementation model proposed by Mintzberg and Quinn (1996) and the repeated non-cooperative game (model) of collaboration formation with the distribution of payoffs within the collaboration according to a fixed rule (Navaretti and Carraro, 1996) were used in this study. Application of the strategy formulation and implementation model in the four stages of the non-cooperative game in R&D was assessed. The models are presented in Figure 1 and Figure 2 respectively.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1   Research Design

This was a descriptive study based on a cross-sectional survey design. This design was preferred because it has the advantage of generating considerable amount of information. Both quantitative and qualitative techniques were employed in the study. Kiggundu (1983) and colleagues suggest that the use of combined quantitative and qualitative research approaches in studying problems in developing countries yields better results. Hart (1987) also argued for the appropriateness of both quantitative and qualitative designs in social science research. This suggests that the use of a combination of approaches is a plausible research strategy.

3.2   Population

The population for this study were all research-based institutions in Kenya. A list of these institutions is presented in Appendix 5.

Research and development settings from the private sector were not included primarily because, in undertaking the study, we assumed that competitive intensity overrides collaborative necessity in the private sector. In our population of interest, it is held that social benefits take precedence over economic benefits collaborative R&D is undertaken.

3.3   Sampling Plan

Our sampling frame comprised of Kenyan based research institutions that undertake international collaborative R&D amongst the population of interest. An ID was assigned to each institution. We then employed continuous simple random sampling until we obtained twenty-seven collaborative research settings that had been

engaged in international collaborative R&D for the last four (4) years. (See appendices 3 and 4).

Once the twenty-seven collaborative research settings were selected, systematic random sampling was used to select three respondents from each of the institution to constitute a total of eighty-one (81) interviewees. These formed the sampling frame for the study.

3.4   Data Collection

Personal interviews were used for data collection. The choice for this method was due to the fact that personal interviews allow in-depth investigations. Personal interviews also have the potential of yielding the highest quality of data compared to other modes (Peterson, 1982). It also tends to be most flexible.

Whenever personal interviews became difficult, drop and pick technique was used. In such circumstances, follow up was done through telephone, e-mail and personal visits. At their request, 16% of the respondents preferred to fill the questionnaire online.

Data was collected through the use of semi-structured questionnaires (see Appendix 2). Probes were used in order to clarify certain issues and improve data reliability. While the benefits of structured interview was reflected in the comparison and comparability of data, the unstructured dimension of the interviews (probes) helped preserve the richness of data, thus maximizing the benefits of the process used.

Whenever possible, scheduled interviews were arranged with the target respondents (research coordinators and research officers). Telephone calls were made prior to visiting the respondent so that ample time was planned for ahead of the interview. Where time was a constraint on the part of the respondent, drop and pick method was adopted.

Both the five-point and the seven-point metrics (five-point and seven-point likert scale) were used. Whereas the five-point likert scale has been used in many management research studies, the seven-point likert scale has been used in other areas of strategy (Fox, 1992).

To be included in the study, the R&D setting was required to have a research link with a foreign institution. The setting needed to have been in existence for at least four years (i.e. the setting must have been in existence by January 1999).

Key respondents were targeted on the basis that they are knowledgeable about partner selection for collaborative R&D; have been intimately involved in collaborative R&D for at least two years and were comfortable in answering the questionnaire (See Appendix 4).

Once the questionnaires were completed, they were screened to ensure completeness of information, coded and the data entered in the computer database using SPSS. MS-Word was used for collating qualitative information.

3.5 Data Analysis and Presentation

Multiple regression analysis was used for data analysis. This method was selected on the basis that the extent, direction and strength of relationship between several independent variables and the dependent variable could be analyzed.

To check the robustness of our regression models, we used the adjusted multiple coefficient of determination, R^2_a. This was selected on the basis that it takes into account both the sample size and the number of beta parameters in the model. This was further strengthened by hypotheses testing using the F statistic.

In this report, data will be presented using tables depicting mean scores, coefficients (ß-values) and correlations matrices.

CHAPTER FOUR

DATA ANALYSIS AND FINDINGS

4.1   Introduction and general remarks

In this section, we outline the response rates received from our study and make some few remarks on the characteristics of our respondent research settings. Subsequent sections will detail our findings based on the study objectives.

Our sample consisted of twenty research-based institutions. Twenty-seven collaborative research settings in these institutions participated in the study, undertaken over a period of one month. The population of the research-based institutions was obtained from the National Council for Science and Technology (NCST) and complimented by references from two of the leading national directories from Postel Kenya and Nation Media Group.

Sixty-four questionnaires were sent out, out of which 39 (61%) were received back. A number of techniques were used to administer the questionnaires. Drop and pick method was used on 53% of the respondents; scheduled interviews on 31% of the respondents and online questionnaires on 16% of the respondents. Online questionnaires were requested for by the respondents, some of whom were busy with scheduled travels during the period of study.

Eleven (31%) of the collaborative research settings participating in the study had no strategic plans. Seven (20%) had draft strategic plans (and therefore the implementation had not yet started); while the other 49% had formal strategic plans which were under implementation. We observed that in the recent past, there has been an increasing level of awareness on the need to develop strategic plans for the research agenda. In some cases, this need has been externally driven – with either the government compelling the research institutions to develop strategic plans, or the institutions realizing that it is no longer 'business as usual' without a roadmap into the future. In this case, we singled out changes in the external environment as the

compelling force. Generally, capacity on the understanding of strategic management issues was lacking.

International research institutions had strategic plans. The same was found to be true for the national institutions that closely collaborate with the international institutions. In addition, international research institutions had higher research and development budgets compared to local research bodies.

60% of the institutions responding to this study indicated that the motivation for their establishment was technology and knowledge transfer while 16% indicated that they came into being to attract research funding. An equal percentage was established for other reasons such as carrying out policy research and analysis and advising the government on policy issues; bringing critical expertise and technologies and conducting research for development. Only about 8% of the institutions surveyed established collaborative research as a basis for institutional renewal. The response rate on technology and knowledge transfer as the motivation for establishing collaborative R&D is consistent with the findings of Mariti and Smiley (1983) and Hagedoorn and Schakenraad (1991).

About half (49%) of the sampled collaborative research settings had a strategic plan spanning 5 years, while 16% had plans stretching out to 10 years. This characteristic was mostly observed in international research institutions, which also have rolling strategic plans and therefore tend to engage in annual reviews of the strategic plans. Only 11% had strategic plans spanning 3 years.

50% of the organizations that participated in the study indicated that over 40% of their funding depends on the presence of expatriate staff, and 29% have more than 80% of their funding dependent on the presence of expatriate staff.

46% of the respondents categorized their R&D management as biological – where it must adapt continuously to change while 28% said it is deterministic (where the situation changes over time and logic, reason and methods of measuring R&D outputs are prevalent). 15% said it is empirical (rules can be found that apply most of the time) and only 0.05% thought it was chaotic (complex and variable and there are

limits of manageability and where no planning in detail is conducted). In spite of the high number that categorized R&D management as biological, we found, with the exception of international research institutions, little evidence that R&D settings have been continuously adapting to change.

The study showed that the main collaborators for the research settings are international donors and financial institutions. Others include local and international universities, local and international NGOs, National Agricultural Research Institutes (NARIs), private sector organizations as well as, to a small extent, community based organizations. The principal basis for selecting collaborators is financial support followed by expertise. Technology only receives some modest consideration.

4.2   Features of Strategy Formulation and Implementation

We were interested in finding out the features of strategy formulation and implementation exhibited by research-based institutions in Kenya. We set to establish if there is any fit between the organizations that had strategic plans and a number of variables. We also set to find out if there is any relationship between the major components of strategic plans and the implementation parameters. The predictor variables for strategic plan and strategy implementation, plus our findings are discussed in sections 4.2.1 to 4.2.5.

4.2.1 Presence of Strategic Plans

a) Respondents were asked to state whether or not their setting had a strategic plan. They were further asked to rate the importance of various strategy formulation and implementation parameters using a seven likert scale, with a score of 1=Not Important and 7= Very Important. The results are shown in Table 1 below.

1= Not Important   7= Very Important

Table 1: **Importance of various strategy formulation & Impl. parameters**

Strategy formulation and implementation parameter	Mean	Std. Dev.
Vision	6.29	1.71
Organizational structure	5.24	2.20
Culture	4.89	2.00
Politics	4.11	2.23
Internal analysis	5.92	1.91
External analysis	5.55	1.75

N=38

Source: Research data

Table 1 shows that vision; internal analysis and external analysis are amongst the most important factors in strategy formulation and implementation using the mean score.

We also wanted to understand the relationship between the various strategy formulation and implementation parameters. We ran multiple regression analysis with the presence of strategic plan as the dependent variable against these parameters.

We defined our model thus,

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

Where Y = Presence of a strategic plan;

$\beta_{1,2,...5}$ are, respectively, X coefficients for importance of external analysis; importance of politics; importance of organizational structure; importance of culture; importance of vision and importance of internal analysis and ε other factors.

The regression model gave ß-values for vision, internal analysis, external analysis, organizational structure, culture and politics as –0.098; -0.048; 0.036; 0.006; -0.004 and 0.003 respectively. Overall, we found little fit (R^2_a=0.405) between the presence of strategic plan and these variables. The

importance of vision in this model is consistent with literature on strategic management (cf Belderbos, 2003; and Lynch, 2000).

b) We were interested in looking at the relationship between strategic plans and resources made available for implementation not being adequate; there being scarce local talent in collaboration management; the importance of vision in strategy formulation and implementation; culture; whether attaining strategic and operational benefits from collaborative R&D is marked by severe political friction amongst participating organizations as well as the importance of internal analysis and external analysis.

We defined our model thus,

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \varepsilon$$

Where Y = Presence of a strategic plan;

$\beta_{1,2,...7}$ are, respectively, X coefficients for resources made available for implementation are adequate; there is scarce local talent in collaboration management; the importance of vision in strategy formulation and implementation; culture; attaining strategic and operational benefits from collaborative R&D is marked by severe political friction amongst participating organizations; importance of internal analysis; importance of external analysis and ε other factors.

Table 2: Importance of various strategy formulation & implementation parameters

Model	Strategy formulation & implementation parameter	Unstandardized Coefficients	
		B	Std. Error
1	(Constant)	1.654	0.180
	Vision	-0.091	0.033
	Culture	-0.001	0.020
	Internal analysis	-0.048	0.039
	External analysis	0.039	0.049
	Scarce local talent in collaboration management	-0.020	0.023
	Operational benefits marked by severe political friction	0.010	0.032
	Resources made available for implementation are not adequate	0.023	0.019
a	Dependent Variable: Do you have a strategic plan		

N=37

Source: Research data

Table 2 above shows a positive linear relationship between the presence of strategic plan and external analysis (β= 0.039); resources made available for implementation (β=0.023) and attaining strategic and operational benefits from collaborative R&D being marked by severe political friction amongst participating organizations (β= 0.010). These results seem to confirm the importance of external analysis, resources and politics in strategy formulation and implementation. Porter (1980) and Belderbos (2003) have emphasized the importance of analysing the external environment. Penrose (1959) wrote on resource-based view of strategy and Pearce and Robinson (2000), Lynch (2000) amongst others on politics. There was a negative linear relationship between the presence of a strategic plan and vision (β= -0.091), internal analysis, scarcity of local talent in collaboration management and culture. This suggests that as scarcity of local talent in collaboration management increases, strategic plans receive lesser consideration. The overall model was however not robust since R^2_a=0.447. (See Appendix 7 for further details).

c) On the relationship between the presence of strategic plans and various strategy formulation and implementation parameters, respondents were asked to score the extent to which strategy formulation and implementation was characterized by selected strategy parameters. The scoring was based on a five point likert scale, with 1= Not at all and 5= To a very large extent. The results are presented in table 3 below.

Table 3: Features of strategy formulation and implementation

Strategy formulation and implementation feature	Mean	Std. Dev.
Operational benefits are marked by severe political friction	2.00	1.45
Collaboration mainly advances foreign policy objectives	1.95	1.38
Collaboration reduces the costs for undertaking research	3.28	1.58
Coordination costs of running collaboration are very high	2.53	1.54
Governance structures for collaboration are inefficient	2.05	1.32
Foreign collaborators dominate strategy formulation & implement.	2.55	1.52

N=39

Source: Research data

These results suggest that collaboration reduces the costs for undertaking research and that foreign collaborators dominate the strategy process. They further suggest that coordination costs for running collaboration are high.

We also wanted to establish, through multiple regression, the relationship between strategic plans and whether foreign collaborators dominate the strategy formulation and implementation; attaining strategic and operational benefits are marked by severe political friction; coordination costs for collaborative are very high; collaboration reduces the costs for undertaking research; governance structures for collaborative R&D are inefficient and that collaborative R&D mainly advances foreign policy objectives. These respectively became our $\beta_{1,2,...6}$ in the model which we defined as:-

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \varepsilon$$

Where Y = Presence of a strategic plan and ε other factors.

Multiple regression analysis (See Appendix 8), showed a positive linear relationship between the presence of strategic plans and severe political friction ($\beta = 0.021$). This seems to suggest that strategy formulation and implementation in these settings is a political process. Most respondents indicated that coordination costs for R&D are very high. We found that most international organizations undertaking research had formal strategic plans and that their coordination costs were indeed very high. This is consistent with the findings of Veugelers (1997). Our findings would them seem to support that high coordination costs trigger the collaborative research settings to engage in the strategy process. We found a negative linear relationship between the presence of strategic plans and the argument that collaboration in R&D mainly advances foreign policy objectives ($\beta = -0.0117$). This seems to suggest that the more foreign policy objectives are advocated for, the lesser the strategic plans we find.

We found that governance structures that are inefficient and reduced costs for undertaking research tend to undermine the presence of strategic plans. Our model yielded $R^2_a = 0.444$.

d) We were also interested to find out if collaborative research sharpens the competitive edge of organizations and also whether there is scarce local talent in collaboration management. Using the five point liker scale as above, we obtained the results in table 4a.

Table 4a: Factors associated with strategy formulation & implementation

Strategy formulation & implementation factor	Mean	Std. Dev.
Operational benefits marked by severe political friction	2.00	1.45
Collaboration reduces the costs for undertaking research	3.28	1.58
Coordination costs of running collaboration R&D are very high	2.53	1.54
Foreign collaborators dominate strategy formulation & Implement.	2.55	1.52
Collaboration in R&D sharpens competitive edge of organizations	3.80	1.34
There is scarce local talent in collaboration management	2.25	1.69
N=39		

Source: Research data

This shows that collaboration sharpens the competitive edge of organizations besides reducing the costs for undertaking research.

We further sought to map the presence of strategic plans against the strategy formulation and implementation parameters mentioned above. The results of the more rigorous multiple regression analysis are shown in table 4b below.

Table 4b: Factors associated with strategy formulation & implementation

Model	Strategy formulation & implementation factor	Unstandardized Coefficients	
		B	Std. Error
1	(Constant)	1.789	0.104
	Operational benefits marked by severe political friction	0.007	0.028
	Collaboration reduces the costs for undertaking research	-0.047	0.025
	Coordination costs of running collaboration are very high	-0.062	0.023
	Foreign collabs. dominate strategy formulation& implementation	0.020	0.030
	Collaboration sharpens competitive edge of organizations	-0.107	0.034
	There is scarce local talent in collaboration management	-0.016	0.023
a	Dependent Variable: do you have a strategic plan		
	N=39		

Source: Research data

Our model depicted a positive linear relationship between dominated strategy ($\beta=0.02$) and severe political friction ($\beta=0.007$).

This seems to suggest that some level of domination in collaborative R&D is healthy for crafting strategic plans. Equally, politics seem to play some checked role in strategic planning, an observation which is consistent with strategic management literature (c.f. Johnson and Scholes, 2001; Pearce and Robinson, 2000; Lynch, 2000. We also found that scarce local talent in collaboration management; reduced costs for undertaking research and high coordination costs are negatively related to the presence of strategic plans. This model yielded an adjusted multiple coefficient of determination, R^2_a of 0.555.

Although the above models give us some insights on factors that may explain the presence of strategic plans in organizations undertaking collaborative R&D, none of the models is robust enough since all the values for R^2_a are less than 0.70.

4.2.2 Importance of Politics

To determine the importance of politics, respondents were asked to assess the strategy implementation process based on an array of parameters using a seven point likert scale. They were asked to score 1 if they did not agree with the statement provided and 7 if they strongly agreed. Table 5a below shows the factors associated with the importance of politics in strategy implementation.

1= Do not agree   7= Strongly agree

Table 5a: Importance of politics in strategy implementation

Factors associated with politics	Mean	Std. Dev.
Implementation of plans take more time than originally planned	4.92	1.87
Major obstacles surface during implementation than originally envisaged	4.05	2.05
Coordination of implementation is not effective enough	3.44	2.14
Competing activities and/or crises distract attention from planned activities	3.49	2.29
Environmental factors which cannot be controlled distort the implementation process	3.38	2.01
Leadership and direction provided is not adequate	2.79	2.25
Key implementation tasks are not clearly defined	2.62	2.09
Monitoring of implementation is not adequate	3.41	2.22
Strategic decision being implemented is not good	1.97	1.53
Other collaborators do not see the strategic decisions as important	2.82	2.13
Resources made available for implementation are not adequate	4.05	2.35
N=39		

Source: Research data

We found that implementation of most plans takes more time than originally planned; major obstacles surface during implementation than originally envisaged; resources made available for implementation are not adequate and that competing activities and/or crises distract attention from planned activities. These results are suggestive of weak strategic planning processes. We suspect that politics play a big role in this, thus hindering effective strategy implementation. We therefore ran regression analysis with importance of politics as our dependent variable.

Table 5b: Importance of politics in strategy implementation

Model	Factors associated with politics	Unstandardized Coefficients	
		B	Std. Error
1	(Constant)	2.335	1.309
	Implementation of plans take more time than originally planned	0.381	0.341
	Major obstacles surface during implementation than originally envisaged	-0.518	0.330
	Coordination of implementation is not effective enough	0.553	0.337
	Competing activities and/or crises distract attention from planned activities	-0.281	0.275
	Environmental factors which cannot be controlled distort the implementation process	0.489	0.249
	Leadership and direction provided is not adequate	-0.328	0.374
	Key implementation tasks are not clearly defined	0.027	0.365
	Monitoring of implementation is not adequate	-0.132	0.312
	Strategic decision being implemented is not good	0.357	0.461
	Other collaborators do not see the strategic decisions as important	-0.045	0.341
	Resources made available for implementation are not adequate	-0.023	0.275
a	Dependent Variable: importance of politics on strategy formulation and implementation		

N=39

Source: Research data

Our model showed R^2 = 0.243. We found that ineffective coordination of implementation (β=0.553); environmental factors which cannot be controlled (β=0.489) and implementation of plans taking longer than originally envisaged (β=0.381) are all factors positively related to the importance of politics. As these increase, the importance of politics also increases. The poorer the strategy being implemented, the more politics gain prominence. On the other hand, as more obstacles are faced, politics become less important.

4.2.3 Importance of Culture

Table 5c below shows the importance culture is given in strategy formulation process.

Table 5c: Importance of culture in strategy implementation

Model	Strategy form. & implementation variable	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	0.288	0.819		0.352	0.728	-1.389	1.965					
	Vision	-0.827	0.324	-0.707	-2.553	0.016	-1.491	-0.163	0.477	-0.435	-0.262	0.137	7.313
	Mission	0.726	0.266	0.631	2.728	0.011	0.181	1.270	0.580	0.458	0.279	0.196	5.096
	Values	0.468	0.199	0.471	2.355	0.026	0.061	0.875	0.674	0.407	0.241	0.262	3.819
	Org. structure	0.168	0.164	0.185	1.022	0.315	-0.169	0.505	0.621	0.190	0.105	0.321	3.119
	Systems	0.246	0.130	0.302	1.896	0.068	-0.020	0.511	0.603	0.337	0.194	0.413	2.422
	Power	-0.026	0.170	-0.031	-0.154	0.878	-0.374	0.321	0.461	-0.029	-0.016	0.259	3.858
	Politics	0.103	0.148	0.115	0.698	0.491	-0.199	0.405	0.549	0.131	0.071	0.387	2.584
	Internal analysis	-0.231	0.260	-0.221	-0.889	0.381	-0.764	0.302	0.430	-0.166	-0.091	0.170	5.886
	External analysis	0.276	0.304	0.242	0.910	0.370	-0.346	0.899	0.450	0.170	0.093	0.148	6.753

a Dependent Variable: Importance of culture on strategy formulation and implementation
N=38

Source: Research data

We found a strong positive linear relationship between the importance of culture and mission (β=0.726). These results suggest that having a mission can have profound influence on culture. Values and external analysis were of less significance in explaining the importance of culture, with β values of 0.468 and 0.276 respectively. The survey showed that there is negative linear relationship between the importance of culture and vision (β= -0.827) as well as internal analysis (β= -0.231). The overall model on the importance of culture yielded R^2_a = 0.612 and R^2 of 0.706. This implies that for the un-adjusted R^2, the model is robust and can be used to predict the importance of culture thus: -

$$Y=0.288-0.827X_1+0.726X_2+0.468X_3+0.168X_4+0.246X_5-0.026X_6+0.103X_7-0.231X_8+0.276X_9$$

Where

Y= Importance of culture;

$X_{1,2,....,9}$ are, respectively, importance of vision, mission, values, organizational structure, systems, power, politics, internal analysis and external analysis.

These results suggest that the importance of culture increases as mission, values, external analysis, systems, organizational structure and politics become more prevalent.

4.2.4 Importance of Organizational Structure

On strategy formulation, we found some positive relationship between the importance of organizational structure and values (β=0.488), internal analysis (β=0.400) and power (β=0.362). These results suggest that as values, internal analysis and power gain prominence in collaborative research settings, the importance of organizational structure also increases.

We also found a negative relationship between organizational structure, mission and systems. We however did not find this negative relationship to be compelling. The overall model showed that R^2_a=0.59. Appendix 3 shows more details on this.

On strategy implementation, we found that key implementation tasks become less clearly defined as the importance of organizational structure increases. This seems to suggest that complex organizational structures have the potential of hindering effective strategy implementation. (See Appendix 9 for more details).

4.2.5 Importance of External Analysis

Respondents were asked to assess the strategy implementation process based on various strategy implementation parameters, scoring 1 if they did not agree and 7 if they strongly agreed with the statements provided. Table 5d shows the importance of external analysis in strategy implementation.

Table 5d: Importance of external analysis in strategy implementation

Strategy implementation factors	Mean	Std. Dev
Implementation of plans take more time than originally planned	4.92	1.87
Major obstacles surface during implementation than originally envisaged	4.05	2.05
Coordination of implementation is not effective enough	3.44	2.14
Competing activities and/or crises distract attention from planned activities	3.49	2.29
Environmental factors which cannot be controlled distort the implementation process	3.38	2.01
Leadership and direction provided is not adequate	2.79	2.25
Key implementation tasks are not clearly defined	2.62	2.09
Monitoring of implementation is not adequate	3.41	2.22
Strategic decision being implemented is not good	1.97	1.53
Other collaborators do not see the strategic decisions as important	2.82	2.13
Resources made available for implementation are not adequate	4.05	2.35

N=39

Source: Research data

It emerged that implementation of plans takes longer than originally planned; major obstacles surface during implementation; resources made available for implementation are inadequate and competing activities and/or crises distract attention from planned activities. These are features that point towards inadequate analysis of the external environment.

Table 5e below shows the ß-values obtained from the regression model.

Table 5e: Importance of external analysis in strategy implementation

Model	Strategy implementation factors	Unstandardized Coefficients	
		B	Std. Error
1	(Constant)	4.671	1.033
	Implementation of plans take more time than originally planned	0.502	0.270
	Major obstacles surface during implementation than originally envisaged	-0.194	0.261
	Coordination of implementation is not effective enough	-0.053	0.266
	Competing activities and/or crises distract attention from planned activities	-0.387	0.217
	Environmental factors which cannot be controlled distort the impl. process	0.504	0.197
	Leadership n direction provided is not adequate	-0.080	0.295
	Key implementation tasks are not clearly defined	0.088	0.288
	Monitoring of implementation is not adequate	-0.091	0.246
	Strategic decision being implemented is not good	0.335	0.364
	Other collaborators do not see the strategic decisions as important	-0.243	0.270
	Resources made available for implementation are not adequate	-0.227	0.217

N=39

Source: Research data

When we sought to understand the relationship between external analysis and the above mentioned variables, we found that the more environmental factors distort the implementation process (ß=504) and the longer it takes to implement the plans (ß=502), the greater is the importance of external analysis. These factors are positively related to external analysis. On the other hand, when competing activities and/or crises distract attention from planned activities, external analysis becomes less important. Also when major obstacles surface during implementation and other collaborators see the strategic decision as unimportant, external analysis is considered to be of less importance.

4.3 Aspects of strategy formulation and implementation that local personnel play a role in

In order to find out the aspects of strategy formulation and implementation the local personnel play a role in, we looked at the relationship between the presence of strategic plans and the number of local personnel involved in board of directors meetings; those involved in identification of opportunity and risk at the corporate level; those involved in determining resource allocation; those involved in formulating the mission, purpose, philosophy and goals of the R&D setting; analysing the

external environment; identifying most desirable strategic options; selecting long-term objectives; developing annual objectives and short-term strategies; implementing strategic choices; financial resource allocation; management of strategic change and leading strategic initiatives.

We mapped these predictor variables against the response variable, which we isolated as the presence of a strategic plan. Our results for this are discussed in section 4.3.1.

In order to deepen our understanding, we extended our analysis to six other response variables namely, the number of local personnel involved in the board of directors meetings; the number of local personnel involved in analysing the external environment; those involved in selecting long-term objectives; financial resource allocation; management of strategic change and leading strategic initiatives. We varied the response variables accordingly in order to keep the respective models relevant. Our results are discussed in sections 4.3.2 to 4.3.7. We retained our response variable as the presence of a strategic plan.

4.3.1 Strategic Plans

First, we wanted to establish the relationship between the presence of strategic plans and the local personnel involvement in the board of directors meetings; identification of opportunity and risk; determining resource allocation; formulating the mission, purpose, philosophy and goals of the R&D setting and developing R&D profile that reflects internal conditions and capabilities.

We found weak positive linear relationship between the presence of strategic plans and the number of local personnel involved in developing R&D profile that reflects internal conditions and capabilities ($\beta = 0.045$) and resource allocation ($\beta = 0.001$). Identification of opportunity and risk had $\beta = 0.018$. Involvement in the board of directors meetings; and formulating the mission, purpose, philosophy and goals were both negatively related to the presence of strategic plans with β values of -0.004 and; -0.0460 respectively. Our R^2 turned out to be 0.116.

These results suggest that the number of local personnel involved in the various dimensions we looked at offers little explanation to the presence of strategic plans. They also suggest that engaging more local personnel in determining resource allocation and those determining the R&D profile that reflects internal conditions and capabilities would be a positive development in strategy formulation within the R&D settings.

4.3.2 Board of Directors Meetings

The table below shows the relationship between local personnel involvement and components of strategy formulation and implementation.

Table 5f: Relationship between local personnel involvement in board of directors' meetings & other functions

Model	Functions local personnel are involved in	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	95% Confidence Interval for B Lower Bound	Upper Bound	Correlations Zero-order	Partial	Part	Collinearity Statistics Tolerance	VIF
1	(Constant)	1.051	0.837		1.255	0.221	-0.677	2.780					
	Identification of opportunity n risk at the corporate level	0.835	0.195	0.656	4.285	0.000	0.433	1.237	0.681	0.658	0.350	0.285	3.510
	Determining resource allocation at corporate level	-0.120	0.253	-0.062	-0.473	0.640	-0.643	0.403	0.396	-0.096	-0.039	0.392	2.553
	Formulating the mission, purpose, philosophy and goals of the R&D setting	-0.232	0.378	-0.789	-0.615	0.544	-1.012	0.547	0.032	-0.125	-0.050	0.004	246.395
	Developing R&D profile that reflects internal conditions and capabilities	-0.112	0.376	-0.380	-0.298	0.768	-0.889	0.664	0.067	-0.061	-0.024	0.004	242.123
	Analysis of external environment	0.561	0.398	1.879	1.410	0.171	-0.260	1.382	0.051	0.277	0.115	0.004	265.694
	Analyzing the options of R&D setting by matching its resources with external environment	-0.158	0.304	-0.531	-0.518	0.609	-0.785	0.470	0.096	-0.105	-0.042	0.006	157.008
	Identifying the most desirable strategic options	-2.811	0.491	-9.401	-5.719	0.000	-3.825	-1.797	0.069	-0.759	-0.468	0.002	404.322
	Selecting long-term objectives	2.332	0.407	7.794	5.731	0.000	1.492	3.172	0.021	0.760	0.468	0.004	276.767
	Developing annual objectives and short term strategies	0.760	0.301	2.550	2.525	0.019	0.139	1.381	0.041	0.458	0.206	0.007	152.572
	Implementing strategic choices	-0.399	0.238	-1.340	-1.679	0.106	-0.889	0.091	0.036	-0.324	-0.137	0.010	95.257
	Financial resource allocation	0.198	0.431	0.667	0.460	0.649	-0.691	1.087	0.135	0.094	0.038	0.003	313.774
	Management of strategic change	-0.239	0.430	-0.802	-0.555	0.584	-1.126	0.649	0.117	-0.113	-0.045	0.003	312.153
	Leading strategic initiatives	0.092	0.282	0.309	0.324	0.749	-0.491	0.675	0.072	0.066	0.027	0.007	135.659

a Dependent Variable: Local personnel are involved in board of directors meeting

N=38

Source: Research data

We found a strong fit between participation of local personnel in the board of directors meetings and strategy formulation and implementation, with a robust model of $R^2_a = 0.753$. Of significant importance was that setting long-term objectives ($\beta=2.332$), identification of opportunity and risk ($\beta=0.835$) and developing annual objectives and short-term strategies ($\beta=0.760$) as well as analysis of the external environment ($\beta=0.561$) are all positively related to local personnel involvement in the board. This suggests that an increase in any of these variables would lead to greater involvement of local personnel in the board of directors meetings. This is consistent with the strategic management literature, and in particular the corporate governance literature on the roles and responsibilities of the board (cf Mintzberg, 1984; Pound, 1995; Shahid, 2001). It is however surprising that analysis of the external environment is not given as much attention. We found that most respondents rated the business environment they are operating in as fairly stable; a factor which could be linked to the low scores on analysis of the external environment.

The study showed that there is negative linear relationship between identification of the most desirable strategic options and local personnel involvement in the board ($\beta= -2.811$); implementing strategic choices ($\beta= -0.399$) and management of strategic change ($\beta= -0.239$).

The model for predicting the number of local personnel involved in the board of directors' meetings is, thus;

$$Y=1.051+0.835X_1-0.120X_2-0.232X_3-0.112X_4+0.561X_5-0.158X_6-2.811X_7+2.332X_8+0.760X_9-0.399X_{10}+0.198X_{11}-0.239X_{12}+0.092X_{13}$$

Where

Y= Number of local personnel involved in the board of director's meetings;

$X_{1,2,...,13}$ are, respectively, the number of local personnel involved in identification of opportunity and risk at the corporate level; determining resource allocation at corporate level; formulating the mission of the R&D setting, purpose, philosophy and the goals of the R&D setting; developing the R&D profile that reflects internal conditions and capabilities; analysis of the external environment; identifying the most desirable strategic options; selecting long-term objectives; developing annual

objectives and short-term strategies; implementing strategic choices; financial resource allocation; management of strategic change; and leading strategic initiatives.

4.3.3 Analysis of External Environment

Table 5g shows the results on the involvement of local personnel in the analysis of external environment.

Table 5g: Relationship between involvement in analysis of external environment & other functions

Model	Functions local personnel get involved in	Unstandardized Coefficients	
		B	Std. Error
1	(Constant)	-0.028	0.426
	Identification of opportunity and risk at the corporate level	-0.083	0.127
	Determining resource allocation at corporate level	-0.033	0.125
	Formulating the mission, purpose, philosophy and goals of the R&D setting	0.168	0.185
	Developing R&D profile that reflects internal conditions and capabilities	-0.136	0.184
	Analyzing the options of R&D setting by matching its resources with external environment	0.168	0.147
	Identifying the most desirable strategic options	1.076	0.301
	Selecting long term objectives	-0.359	0.300
	Developing annual objectives and short term strategies	0.120	0.165
	Implementing strategic choices	-0.035	0.124
	Financial resource allocation	-0.157	0.211
	Management of strategic change	0.072	0.213
	Leading strategic initiatives	0.083	0.139
	Board of directors meetings	0.136	0.097
a	Analysis of external environment		

N=38

Source: Research data

In analysing the external environment, we found that identifying the most desirable options was the best positive predictor (β= 1.076) in our model. The other positive predictors were formulating the mission, purpose, philosophy and goals of the R&D setting (β= 0.168) and analyzing the options of R&D setting by matching its resources with external environment (β= 0.168) amongst others. There was negative relationship between analysis of the external environment and selection of long-term objectives (β= -0.359) and financial resource allocation (β= -0.157) amongst others. The model summary, R^2_a = 0.995 is presented as Appendix 10.

These results suggest a positive linear relationship between analysis of external environment in collaborative research and the selection of most desirable strategic options; formulation of mission, purpose and goals as well as the engagement of local personnel in matching resources with external environment. They further suggest that there is a negative relationship between the importance of external analysis and selection of long-term objectives as well as financial resource allocation. The weak value for managing strategic change as a predictor for involvement in external analysis might also suggest that greater involvement in strategic change management efforts yields only marginal improvements in analysis of external environment. It would be important to study this area in future. Equally, it would be important to investigate why local personnel involvement in analysing the external environment would reduce with increased engagement in identification of the most desirable strategic options, implementation of strategic choices and identification of opportunity and risk.

Our model for predicting the involvement of local personnel in the analysis of external environment is, thus;

$$Y = -0.028 + 0.083X_1 - 0.033X_2 + 0.168X_3 - 0.136X_4 + 0.168X_5 + 1.076X_6 - 0.359X_7 + 0.120X_8 - 0.035X_9 - 0.157X_{10} + 0.072X_{11} + 0.083X_{12} + 0.136X_{13}$$

Where
Y = Number of local personnel involvement in the analysis of external environment;
$X_{1,2,...,13}$ are, respectively, the number of local personnel involvement in identification of opportunity and risk at the corporate level; determining resource allocation at corporate level; formulating the mission of the R&D setting, purpose, philosophy and the goals of the R&D setting; developing the R&D profile that reflects internal conditions and capabilities; identifying the most desirable strategic options; selecting long-term objectives; developing annual objectives and short-term strategies; implementing strategic choices; financial resource allocation; management of strategic change; and leading strategic initiatives.

4.3.4 Selection of long-term objectives

Table 5h shows the relationship between local personnel involvement in selection of long-term objectives and other variables.

Table 5h: Relationship between selection of long-term objectives & other functions

Model	Functions local personnel get involved in	Unstandardized Coefficients	
		B	Std. Error
1	(Constant)	-0.164	0.282
	Identification of opportunity and risk at the corporate level	-0.203	0.074
	Determining resource allocation at corporate level	0.017	0.083
	Formulating the mission, purpose, philosophy and goals of the R&D setting	0.146	0.119
	Developing R&D profile that reflects internal conditions and capabilities	-0.038	0.122
	Analyzing the options of R&D setting by matching its resources with external environment	0.107	0.095
	Identifying the most desirable strategic options	0.881	0.096
	Developing annual objectives and short term strategies	-0.284	0.094
	Implementing strategic choices	0.205	0.071
	Financial resource allocation	-0.229	0.133
	Management of strategic change	0.176	0.137
	Leading strategic initiatives	0.037	0.092
	Board of directors meeting	0.240	0.043
a	Dependent Variable: local personnel in selecting long term objectives		

N= 38

Source: Research data

The study showed that in predicting the number of local personnel involved in selecting long-term objectives, identifying the most desirable strategic options ($\beta= 0.881$) is one of the most important factors. Other important variables are the implementation of strategic choices ($\beta= 0.205$) and the board of directors meetings ($\beta= 0.240$), identification of opportunity and risk ($\beta= -0.203$) and developing annual objectives and short-term strategies ($\beta= -0.284$). Our $R^2_a = 0.998$.

We can therefore confidently predict the number of local personnel involved in selecting long-term objectives in collaborative research institutions thus;

$$Y=-0.164-0.203X_1+0.017X_2+0.146X_3-0.038X_4+0.107X_5+0.881X_6-0.284X_7+0.205X_8-0.229X_9+0.176X_{10}+0.037X_{11}+0.240X_{12}$$

Where

Y= Number of local personnel involved in selecting long-term objectives;

$X_{1,2,...,12}$ are, respectively, the number of local personnel involvement in identification of opportunity and risk at the corporate level; determining resource allocation at corporate level; formulating the mission of the R&D setting, purpose, philosophy and the goals of the R&D setting; developing the R&D profile that reflects internal conditions and capabilities; identifying the most desirable strategic options; developing annual objectives and short-term strategies; implementing strategic choices; financial resource allocation; management of strategic change; leading strategic initiatives; board of directors meetings; analysis of the external environment.

4.3.5 Financial resource allocation

Table 5i below shows the results on the relationship between number of local personnel involved in financial resource allocation and selected strategy formulation and implementation variables.

Table 5i: Relationship between local personnel involvement in financial resource allocation & other functions

Model	Various activities local personnel get involved in	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	0.000	0.408		0.000	1.000	-0.842	0.842					
	Selecting long term objectives	-0.505	0.277	-0.502	-1.824	0.081	-1.077	0.067	0.981	-0.349	-0.021	0.002	576
	Formulating the mission, purpose, philosophy and goals of the R&D setting	0.054	0.179	0.055	0.301	0.766	-0.316	0.424	0.958	0.061	0.003	0.004	249
	Determining resource allocation at corporate level	0.129	0.117	0.020	1.099	0.283	-0.113	0.371	-0.063	0.219	0.013	0.408	2
	Developing R&D profile that reflects internal conditions and capabilities	-0.077	0.177	-0.077	-0.432	0.670	-0.442	0.289	0.966	-0.088	-0.005	0.004	241
	Board of directors meeting	0.044	0.096	0.013	0.460	0.649	-0.154	0.242	-0.135	0.094	0.005	0.162	6
	Identification of opportunity and risk at the corporate level	-0.194	0.116	-0.045	-1.680	0.106	-0.433	0.044	-0.134	-0.324	-0.019	0.180	6
	Developing annual objectives and short term strategies	0.056	0.159	0.056	0.352	0.728	-0.273	0.385	0.973	0.072	0.004	0.005	192
	Management of strategic change	0.722	0.141	0.721	5.108	0.000	0.430	1.014	0.997	0.722	0.059	0.007	151
	Leading strategic initiatives	0.231	0.125	0.232	1.852	0.076	-0.026	0.489	0.991	0.354	0.021	0.008	119
	Implementing strategic choices	0.054	0.118	0.054	0.459	0.650	-0.189	0.298	0.970	0.093	0.005	0.009	106
	Analyzing the options of R&D setting by matching its resources with external environment	-0.027	0.144	-0.027	-0.185	0.855	-0.324	0.271	0.990	-0.038	-0.002	0.006	159
	Analysis of external environment	-0.144	0.193	-0.143	-0.744	0.464	-0.542	0.255	0.982	-0.150	-0.009	0.004	281
	Identifying the most desirable strategic options	0.633	0.332	0.629	1.904	0.069	-0.053	1.318	0.984	0.362	0.022	0.001	830

a Dependent Variable: local personnel in financial resource allocation

N=38

Source: Research data

Our model gave a value of $R^2_a = 0.995$; indicating that we can reliably predict how many local personnel will be involved in financial resource allocation based on the variables mentioned below. We found that the number of personnel involved in management of strategic change ($\beta = 0.722$) exerts the greatest influence on financial resource allocation. This is followed by identification of most desirable strategic options ($\beta = 0.633$). Surprisingly, we found that as the number of local personnel involved in identification of opportunity and risk at the corporate level increases, the number involved in financial resource allocation reduces. It would be important to examine further why this is so, given the close relationship between financial management and risk management. We present this model as follows: -

$$Y=-0.505X_1+0.054X_2+0.129X_3-0.077X_4+0.044X_5-0.194X_6+0.056X_7+0.722X_8+0.231X_9+0.054X_{10}-0.026X_{11}-0.144X_{12}-0.633X_{13}$$

Where
$Y=$ Number of local personnel involved in financial resource allocation;
$X_{1,2,\ldots,13}$ are, respectively, the number of local personnel involvement in identification of opportunity and risk at the corporate level; determining resource allocation at corporate level; formulating the mission of the R&D setting, purpose, philosophy and the goals of the R&D setting; developing the R&D profile that reflects internal conditions and capabilities; identifying the most desirable strategic options; developing annual objectives and short-term strategies; implementing strategic choices; management of strategic change; leading strategic initiatives; board of directors meetings; analysis of the external environment and selecting long-term objectives.

4.3.6 Management of strategic change

Table 5j below shows how local personnel are involved in the management of strategic change.

Table 5j: Relationship between management of strategic change & other functions

Model	Functions local personnel get involved in	Unstandardized Coefficients	
		B	Std. Error
1	(Constant)	0.134	0.403
	Identification of opportunity and risk at the corporate level	0.030	0.122
	Determining resource allocation at corporate level	0.018	0.115
	Formulating the mission, purpose, philosophy and goals of the R&D setting	-0.268	0.136
	Developing R&D profile that reflects internal conditions and capabilities	0.282	0.145
	Identifying the most desirable strategic options	-0.526	0.341
	Developing annual objectives and short term strategies	-0.067	0.158
	Implementing strategic choices	0.070	0.118
	Leading strategic initiatives	0.142	0.130
	Board of directors meeting	-0.069	0.096
	Analysis and external environment	0.124	0.190
	Selecting long term objectives	0.488	0.270
	Financial resource allocation	0.755	0.140
a	Dependent Variable: local personnel in management of strategic change		

N=38

Source: Research data

Given the importance of management of strategic change in a rapidly changing environment, we were interested in finding out if we can reliably predict the number of local personnel involved in managing this change. Our model turned out to be robust, with $R^2_a = 0.995$.

In predicting how many local personnel are involved in management of strategic change, we found that the number involved in financial resource allocation ($\beta= 0.755$) and the number involved in selection of long-term objectives ($\beta= 0.488$) provide the best two predictor variables for the positive linear relationship. Thus, as these numbers increase, we are likely to see an increasing number of local personnel involved in the management of strategic change management.

Our study also showed that as we increase the number of local personnel involved in identifying the most desirable options ($\beta= -0.526$), the number of local personnel involved in managing strategic change reduces.

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We present our model and findings on this below.

$$Y = 0.134 + 0.03X_1 + 0.018X_2 - 0.268X_3 + 0.282X_4 - 0.526X_5 - 0.067X_6 + 0.07X_7 + 0.142X_8 - 0.069X_9 + 0.124X_{10} + 0.488X_{11} + 0.755X_{12}$$

Where

Y= Number of local personnel involved management of strategic change;

$X_{1,2,\dots,12}$ are, respectively, the number of local personnel involvement in identification of opportunity and risk at the corporate level; determining resource allocation at corporate level; formulating the mission of the R&D setting, purpose, philosophy and the goals of the R&D setting; developing the R&D profile that reflects internal conditions and capabilities; identifying the most desirable strategic options; developing annual objectives and short-term strategies; implementing strategic choices; leading strategic initiatives; board of directors meetings; analysis of the external environment; selecting long-term objectives and financial resource allocation.

More information is given in the correlations matrix on page 53.

Table 5k: Local personnel involvement in management of strategic change and other functions - Correlations Matrix

		a	b	c	d	e	f	g	h	I	j	k	l	m
Pearson Correlation	a	1	-0.129	-0.061	0.959	0.968	0.983	0.972	0.971	0.991	-0.117	0.981	0.983	0.997
	b	-0.129	1	0.624	-0.014	-0.057	-0.039	-0.042	-0.037	-0.072	0.681	-0.036	-0.034	-0.134
	c	-0.061	0.624	1	0.014	-0.019	-0.059	-0.033	-0.016	-0.045	0.396	-0.055	-0.047	-0.063
	d	0.959	-0.014	0.014	1	0.995	0.969	0.983	0.978	0.960	-0.032	0.970	0.972	0.958
	e	0.968	-0.057	-0.019	0.995	1	0.971	0.985	0.979	0.964	-0.067	0.972	0.973	0.966
	f	0.983	-0.039	-0.059	0.969	0.971	1	0.985	0.979	0.987	-0.069	0.998	0.996	0.984
	g	0.972	-0.042	-0.033	0.983	0.985	0.985	1	0.992	0.969	-0.041	0.986	0.984	0.973
	h	0.971	-0.037	-0.016	0.978	0.979	0.979	0.992	1	0.965	-0.036	0.979	0.982	0.970
	I	0.991	-0.072	-0.045	0.960	0.964	0.987	0.969	0.965	1	-0.072	0.986	0.987	0.991
	j	-0.117	0.681	0.396	-0.032	-0.067	-0.069	-0.041	-0.036	-0.072	1	-0.051	-0.021	-0.135
	k	0.981	-0.036	-0.055	0.970	0.972	0.998	0.986	0.979	0.986	-0.051	1	0.995	0.982
	l	0.983	-0.034	-0.047	0.972	0.973	0.996	0.984	0.982	0.987	-0.021	0.995	1	0.981
	m	0.997	-0.134	-0.063	0.958	0.966	0.984	0.973	0.970	0.991	-0.135	0.982	0.981	1

Legend

a	Management of strategic change	h	Implementing strategic choices
b	Identification of opportunity and risk at the corporate level	I	Leading strategic initiatives
c	Determining resource allocation at corporate level	j	Board of directors meeting
d	Formulating the mission, purpose, philosophy n goals of the R&D setting	k	Analysis of external environment
e	Developing R&D profile that reflects internal conditions and capabilities	l	Selecting long term objectives
f	Identifying the most desirable strategic options	m	Financial resource allocation
g	Developing annual objectives and short term strategies		

N=38

Source: Research data

4.3.7 Leading strategic initiatives

We finally sought to see if we could model the number of local personnel who lead strategic initiatives. The results are presented in table 5l below.

Table 5l: Relationship between leading strategic initiatives & other functions

Model	Functions local personnel get involved in	Unstandardized Coefficients	
		B	Std. Error
1 (Constant)		-0.568	0.612
	Identification of opportunity and risk at the corporate level	0.172	0.183
	Determining resource allocation at corporate level	-0.128	0.182
	Formulating the mission, purpose, philosophy and goals of the R&D setting	0.363	0.264
	Developing R&D profile that reflects internal conditions and capabilities	-0.258	0.267
	Analyzing the options of R&D setting by matching its resources with external environment	0.139	0.218
	Identifying the most desirable strategic options	-0.092	0.544
	Developing annual objectives and short term strategies	-0.136	0.242
	Implementing strategic choices	-0.233	0.175
	Board of directors meeting	0.048	0.147
	Analysis and external environment	0.177	0.296
	Selecting long term objectives	0.236	0.449
	Financial resource allocation	0.540	0.292
	Management of strategic changes	0.267	0.307
a	Dependent Variable: Leading strategic initiatives		
	N=38		

Source: Research data

Our model was robust, with R^2_a = 0.989. We isolated involvement in financial resource allocation (β= 0.540), formulating mission, purpose, philosophy and goals of the R&D setting (β= 0.363), management of strategic change (β= 0.267) and selection of long-term objectives (β= 0.236) to be the strongest positively related factors to leading strategic initiatives. We further established that developing R&D profile that reflects internal conditions and capabilities (β= -0.258) and implementing strategic choices (β= -0.233) are negatively related to leading strategic initiatives.

These results suggest that as more local personnel get involved in financial resource allocation, formulation of mission and purpose of the R&D setting, management of

strategic change, selection of long-term objectives and analysis of external environment amongst others, their role in leading strategic initiatives is enhanced. On the other hand, as more local personnel are involved in developing R&D profile that reflects internal conditions and capabilities and implementing strategic choices, their role in leading strategic initiatives diminishes.

These findings seem to reaffirm the importance of financial resources in implementing strategic objectives, and the close link between strategy and mission on the one hand and strategy implementation as a process of managing change on the other hand. More details on this model are provided in Appendix 11.

From these findings, we present the model, thus;

$$Y=-0.568+0.172X_1-0.128X_2+0.363X_3-0.258X_4+0.139X_5-0.092X_6-0.136X_7-0.233X_8+0.048X_9+0.177X_{10}+0.236X_{11}+0.540X_{12}+0.267X_{13}$$

Where

Y = Number of local personnel involved in leading strategic initiatives;

$X_{1,2,...,13}$ are, respectively, the number of local personnel involvement in identification of opportunity and risk at the corporate level; determining resource allocation at corporate level; formulating the mission of the R&D setting, purpose, philosophy and the goals of the R&D setting; developing the R&D profile that reflects internal conditions and capabilities; analysing the options of the R&D setting by matching its resources with the external environment; identifying the most desirable strategic options; developing annual objectives and short-term strategies; implementing strategic choices; board of directors meetings; analysis of the external environment; selecting long-term objectives; financial resource allocation and management of strategic change.

4.4 Factors that influence participation of local personnel in strategy formulation and implementation

We were interested in finding out what factors influence the participation of local personnel in strategy formulation and implementation. We looked at these factors in light of five parameters namely formulating the mission of the R&D setting, purpose, philosophy and the goals of the R&D setting; analysis of the external environment; setting long-term objectives; implementing strategic choices; management of strategic change and leading strategic objectives.

Respondents were asked to rank, on a scale of 1-5, the extent to which shifts in partners objectives and expectations; waning managerial attention; clashes in corporate culture; poor communication; complexity of the collaboration; environmental turbulence; lack of clarity on which parent to be answerable to; size differences amongst partners; differences in technology amongst partners and patent problems affect the participation of local personnel in the R&D setting.

Table 5m shows the results obtained.

1= Not at all   5= To a very large extent

Table 5m: Factors affecting participation of local personnel in strategy form. & impl.

	Mean	Std. Deviation
Shifts in partners objectives and expectations	1.92	1.70
Waning managerial attention	1.97	1.95
Clashes in corporate culture	1.61	1.70
Poor communication	2.66	1.85
Complexity of the collaboration	2.24	1.84
Environmental turbulence	1.50	1.66
Lack of clarity on which parent to be answerable	1.58	1.83
Size differences amongst partners	1.92	1.78
Differences in technology amongst partners	1.95	1.97
Patent problems	1.66	1.77
Heterogeneity of research initiatives	1.50	1.67

N=39

Source: Research data

These results indicate that poor communication, complexity of the collaboration and waning managerial attention are the three most important factors that affect participation of local personnel in strategy formulation and implementation. We were further interested in finding out the relationship between these variables and formulation of mission, purpose and goals; analysis of external environment; selection of long-term objectives; financial resource allocation; management of strategic change and leading strategic initiatives respectively. A summary of the results obtained from regression analysis is presented in table 5n below.

Table 5n: β values for factors that influence participation of local personnel in strategy formulation & implementation

Predictor Variable	Response Variable					
	A	B	C	D	E	F
Shifts in partners' objectives and expectations	0.881	0.166	0.248	-1.312	-1.356	-0.353
Waning managerial attention	-0.513	-0.328	0.073	0.388	0.476	-0.052
Clashes in Corporate culture	1.741	1.176	1.057	1.789	1.733	1.417
Poor communication	-1.761	-0.220	-0.636	-0.404	-0.522	-0.195
Complexity of the collaboration	-3.270	-3.741	-3.554	-3.988	-4.197	-4.065
Environmental turbulence	-2.776	-1.294	-1.783	-1.494	-1.454	-1.902
Lack of clarity on which parent to be answerable to	-0.134	-1.231	-0.944	-1.870	-1.566	-1.008
Size differences amongst partners	-2.043	-1.139	-1.168	-0.459	-0.096	-0.610
Differences in technology amongst partners	4.927	4.511	4.660	4.710	4.669	4.560
Patent problems	1.710	1.596	1.887	1.211	0.870	1.320
Heterogeneity of research initiatives	-5.041	-4.141	-4.238	-3.712	-3.474	-4.240
R^2	0.226	0.179	0.179	0.191	0.184	0.197

Legend:
A - Formulating mission, purpose, philosophy and goals
B - Analysis of the external environment
C - Setting long-term objectives
D - Financial resource allocation
E - Management of strategic change
F - Leading strategic initiatives

N=39   Source: Research data

The findings are discussed in sections 4.4.1 to 4.4.6.

4.4.1 Factors affecting local personnel in the formulation of mission, purpose and goals

Differences in technology amongst partners; clashes in corporate culture; patent problems and shifts in partners' objectives and expectations and lack of clarity on which parent the collaborative R&D should be answerable to (only applicable when there are multiple parents) are, respectively, the dominant factors positively related to the local personnel's participation in the strategy formulation and implementation process. These results suggest that the predictor variables we incorporated in our model tend to spur participation of local personnel in formulating the mission, purpose, philosophy and goals of the R&D settings. We further found that heterogeneity of research initiatives; complexity of the collaboration and environmental turbulence tend to hinder participation in the formulation of mission, purpose and goals. As our study was cross-sectional, it would be important to, in future, carry out a longitudinal study to see how these parameters change over time.

4.4.2 Factors affecting participation of local personnel in analyzing external environment

Heterogeneity of research initiatives; complexity of the collaboration and environmental turbulence inhibit local personnel from analyzing external environment. On the other hand, differences in technology; patent problems and clashes in corporate culture are positively related to analyzing external environment.

These results suggest that as complexity of collaboration increases, external analysis receives lesser attention. In addition, the larger the environmental turbulence, the lesser the number of locals that participate in external analysis; an important aspect in strategy formulation and implementation. Although we would expect environmental turbulence to distract people from the strategy process, it is interesting that engagement in external analysis reduces as the turbulence increases. There is need to undertake further research to establish why this is so.

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4.4.3 Factors affecting local personnel from selecting long-term objectives

Differences in technology; patent problems and clashes in corporate culture are positively related to the selection of long-term objectives. These factors seem to motivate the local personnel to select long-term objectives in their outfits. On the other hand, heterogeneity of research initiatives; complexity of collaboration and environmental turbulence are some of the factors that hinder the local personnel participation in selecting long-term objectives.

4.4.4 Factors affecting local personnel in financial resource allocation

We found differences in technology to be the dimension that significantly affects local personnel participation in financial resource allocation. We further observed that amongst other factors, lack of clarity on which parent to be answerable to; environmental turbulence and shifts in partners' objectives and expectations undermine local personnel participation in financial resource allocation. Amazingly, our study revealed that as communication gets poorer in these settings, the level of participation of local personnel in financial resource allocation diminishes. It will be important to look at the interface between internal (within the R&D setting) and external (with the foreign collaborators) communication and how these two affect the participation in financial resource allocation.

4.4.5 Factors affecting local personnel in management of strategic change

Factors affecting local personnel in management of strategic change were similar to those affecting their participation in financial resource allocation. The only exception was that in financial resource allocation, size differences amongst partners affects (negatively) participation of local personnel to a greater extent than poor communication. In management of strategic change, poor communication affects participation to a larger extent than size differences.

The findings seem to reinforce the importance of culture in the much-celebrated literature on management of strategic change.

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4.4.6 Factors affecting local personnel in leading strategic initiatives

On factors that affect local personnel involvement in leading strategic initiatives, we found that differences in technology; clashes in corporate culture and patent problems are, respectively, the main predictors that positively spur local participation in leading strategic initiatives. Complexity of collaboration and environmental turbulence amongst other factors hinder participation in leading strategic initiatives.

Overall, we can conclude that whereas differences in technology, clashes in corporate culture and patent problems tend to spur local personnel participation in strategy formulation and implementation, heterogeneity in research initiatives, complexity of collaboration and environmental turbulence hinder participation. We contend that local personnel lack capacity to absorb shocks caused by external environment, thus reducing their participation. Poor communication, complexity of the collaboration, waning managerial attention, environmental turbulence and shifts in partners' objectives and expectations hinder participation in strategy formulation.

4.5   Hypotheses Testing

In testing our hypotheses, we used the F-statistic. We tested all the hypotheses at 95% confidence level using the one-tailed test.

H1: We hypothesized that the R&D settings lack a clear strategy on what their future direction is or will be, and that this tends to increase the level of friction amongst these settings.

We took lack of strategy to be represented by either presence or lack of a strategic plan in the research setting. We then took friction in these settings to be represented by implementation of plans taking longer than originally planned; major obstacles surfacing during the implementation than initially envisaged; coordination of implementation not being effective enough; competing activities and/or crises distracting attention from planned activities; environmental factors distorting the

implementation process; leadership and direction provided not being adequate; strategic decision being implemented rated as poor; other collaborators not seeing the strategic decision as important and resources made available not being adequate. These comprised our β values.

We designed our hypothesis thus;

$H_0: \beta_i = 0$

$H_A: \beta_i \neq 0$

(Where i = 1,2,3, … 11 represented by the above-mentioned parameters).

We then compared our values for the calculated F value (F_{ca}) against the critical F values (F_{cr}) and rejected H_0 when $F_{ca} > F_{cr}$

We found that;

$F_{ca} = 2.552; F_{cr} = 2.17$

This prompted us to reject H_0, confirming that R&D settings lack a clear strategy at 95% confidence level. We accepted H1.

H2: *International collaborative R&D settings in Kenya are driven by dominated strategy by their partners from developed countries.*

To test this hypothesis, we stated;

$H_0: \beta_i = 0$

$H_A: \beta_i \neq 0$

(Where i = 1,2,3, …6 respectively represented by, operational benefits from collaborative R&D being marked by severe political friction; R&D collaboration mainly advancing foreign policy objectives; patent rights from research being equally shared; benefits of R&D are geared towards benefiting the foreign researchers more; the level of involvement of local staff in developing strategic plans and number of expatriate staff in senior management).

We aimed at rejecting H_0 if $F_{ca} > F_{cr}$

We found that;

$F_{ca} = 4.678$; $F_{cr} = 2.39$; prompting us to reject H_0. We can therefore state that at 95% confidence level, international collaborative R&D settings in Kenya are driven by dominated strategy by their partners from developed countries. We accepted H2.

H3: Non-cooperative game in international collaborative R&D deters the strategy process, thereby leading to reductionist behaviour in R&D settings in Kenya.

In testing this hypothesis, we proceeded on the premise that R&D should lead to innovation. We held the assumption that if R&D strategy is effective, innovation should be very good or excellent in the R&D setting. We assumed that where innovation is low, it is due to non-cooperative game in R&D.

At the strategy formulation level, we took non-cooperative game to be represented by undesirable factors in collaboration namely shifts in partners' objectives and expectations; waning managerial attention; clashes in corporate culture; poor communication; lack of clarity on which parent to be answerable to; size differences amongst partners; differences in technology amongst partners and patent problems. These constituted out ß values.

For strategy implementation, we took the non-cooperative game to be represented by strategy implementation taking longer than originally planned; major obstacles occurring during implementation; coordination of implementation not being effective enough; competing activities and/or crises distracting attention from planned activities; environmental factors distorting the implementation process; leadership provided not being adequate; key implementation tasks not being clearly defined; monitoring of implementation not being adequate; strategic decision being implemented not good; other collaborators not seeing the strategic decision as important and resources made available not being adequate. These became our ß values.

We then proceeded to test the hypothesis at these two levels.

Strategy formulation:

To test this sub-hypothesis, we stated thus;

H_0: $\beta_i = 0$

H_A: $\beta_i \neq 0$

(Where i = 1,2,3, …8 represented by shifts in partners' objectives and expectations; waning managerial attention; clashes in corporate culture; poor communication; lack of clarity on which parent to be answerable to; size differences amongst partners; differences in technology amongst partners and patent problems respectively).

We aimed at rejecting H_0 if $F_{ca} > F_{cr}$

We found that;

F_{ca} = 0.628; F_{cr}= 2.27; prompting us to fail to reject H_0. We cannot therefore state that at 95% confidence level, the non-cooperative game deters strategy formulation.

Strategy Implementation:

To test this sub-hypothesis, we considered;

H_0: $\beta_i = 0$

H_A: $\beta_i \neq 0$

(Where i = 1,2,3, …11 represented by strategy implementation taking longer than originally planned; major obstacles occurring during implementation; coordination of implementation not being effective enough; competing activities and/or crises distracting attention from planned activities; environmental factors distorting the implementation process; leadership provided not being adequate; key implementation tasks not being clearly defined; monitoring of implementation not being adequate; strategic decision being implemented not good; other collaborators not seeing the strategic decision as important and resources made available not being adequate respectively).

We aimed at rejecting H_0 if $F_{ca} > F_{cr}$

We found that;

F_{ca} = 1.017; F_{cr}=2.17; prompting us to fail to reject H_0. We cannot therefore state that at 95% confidence level, the non-cooperative game deters strategy implementation.

We concluded that since the non-cooperative game cannot be claimed to deter strategy formulation **and** also implementation, we cannot argue that it deters strategy formulation and implementation, thus we failed to accept our H3.

H4: When negotiating collaborative R&D, managers often overlook the structure of collaboration or 'collaboration governance'. Since strategy follows structure, flaws in structure lead to poor strategy formulation and implementation.

Our response variable for this was that governance structures for collaborative R&D are inefficient. We isolated the predictor variables as organizational structure; systems; scarce local talent in collaboration management; the number of local personnel involved in the board meetings; number of expatriate staff involved in the board of directors meetings and level of involvement of local staff in developing strategic plan.

We considered;

H_0: $\beta_i = 0$

H_A: $\beta_i \neq 0$

(Where i = 1,2,3, …6 represented by organizational structure; systems; scarce local talent in collaboration management; the number of local personnel involved in the board meetings; number of expatriate staff involved in the board of directors meetings and level of involvement of local staff in developing strategic plan respectively).

We were to reject H_0 if $F_{ca} > F_{cr}$

We found that;

F_{ca} = 2.976; F_{cr}= 2.41; prompting us to reject H_0. We can therefore state with 95% confidence level that when negotiating collaborative R&D, managers often overlook the collaboration governance. We accepted H4.

H5: Realized strategy in international collaborative R&D settings is primarily explained by emergent components of strategy rather than planned components.

We isolated leadership excellence as reflective of realized strategy based on the assumption that leading organizations tend to have better realization of their strategies. We then proceeded on the premise that emergent strategy is characterized by: - Power dynamics; political friction; major obstacles during implementation; competing activities and/or crises distracting attention and environmental factors distorting the implementation process. This is consistent with the findings of Mintzberg and Quinn (1996). We took planned components of strategy to be presence of strategic plans, type of strategic plan, importance of vision, mission and values. We then took all these components to be our predictor variables.

We calculated the F value for emergent components (F_E) and then calculated the same for planned components (F_P). We modified our hypothesis testing technique as follows: -

H_0: F_E = F_P
H_A: F_E ≠ F_P

We set to reject H_0 if F_E > F_P

We found that;

F_E= 4.642 and F_P = 1.155. We therefore rejected H_0. Thus, we contend that realized strategy is primarily explained by emergent components of strategy rather than planned ones. We accepted H5.

H6: Strategy and implementation in international collaborative R&D settings in Kenya is principally a muddling through process.

We picked management of strategic change as our response variable and mapped this against the following variables: Governance structures for collaborative R&D are inefficient; there is scarce local talent in collaboration management; clashes in corporate culture; poor communication; complexity of the collaboration; environmental factors distort the strategy implementation process and resources made available for strategy implementation being inadequate.

We set;

$H_0: \beta_i = 0$

$H_A: \beta_i \neq 0$

(Where $i = 1,2,3, \ldots 7$ represented by governance structures for collaborative R&D are inefficient, there is scarce local talent in collaboration management, clashes in corporate culture, poor communication, complexity of the collaboration, environmental factors distort the strategy implementation process and resources made available for strategy implementation being inadequate respectively).

We were to reject H_0 if $F_{ca} > F_{cr}$

We found that;

$F_{ca} = 0.814$; $F_{cr} = 2.35$; prompting us to fail to reject H_0. We cannot therefore state that strategy implementation in international collaborative R&D is principally a muddling through process. We failed to accept H6.

CHAPTER FIVE

SUMMARY, DISCUSSIONS AND CONCLUSIONS

In this chapter, we will summarize the findings from the study, discuss them and draw conclusions based on the research objectives.

5.1   Summary, discussions and conclusions

The first objective for this study sought to establish the features of strategy formulation and implementation undertaken in international collaborative R&D settings within research-based institutions in Kenya.

The study showed that collaborative research is guided by dominated strategy by foreign collaborators. These findings contrast Grygolec's (2003) contention that no player will play dominated strategy in collaborative R&D. However, we find that as the duration of strategic plans increases, domination fizzles out, reinforcing the supremacy of the multiplicity of nash equilibria in repeated non-cooperative game as suggested by Petersen and Lewis (1994).

The study showed that there is scarce local talent in collaboration management despite the fact that collaborative research increases the level of learning and reputation of local researchers. We found that research has led to networks of knowledge as witnessed by the fission that has taken place in a number of research institutions. For example, we found that one of the world's leading research institutions based in Kenya sprung up from a mega program that was being undertaken by a bilateral research centre in Kenya in the 1970's. The leading research institution has in turn, to date, yielded many other small research-based collaborative research centres. This is consistent with the findings of Keely (2002). We were inspired that there has been some degree of clustering of collaborative research centres, particularly within major research-based institutions. This might be attributed to the pull factors (such as reputation of the research-based institution and

knowledge concentration) in determining collaborative R&D location. This could also be due to delays in registration of research institutions. For example, one research setting, which has been striving for registration since 1990s, has been operating under a large and established research-based institution, enjoying almost complete autonomy from the parent institution. It is difficult for such an outfit to operate optimally without fully accredited legal status.

We further found that these collaborations mainly advance foreign policy objectives. We suspect that this is due to resource asymmetries, a factor that also explains why strategy formulation and implementation is dominated by foreign collaborators. This reinforces the importance of resource-based view of strategy as articulated by Penrose (1959). In an effort to improve strategic impact, this anomaly will require to be addressed. One way of doing this would be to forge greater south-south R&D collaboration, establish research funds to articulate local research agenda and institutionalise research in the government budget cycle. The study showed that advancing foreign policy objectives undermines the strategy formulation and implementation process.

The study showed that resources made available for implementation of research activities are inadequate. We suspect this could be due to the uncertainty of payoffs from research work, and the duration it takes to realize research benefits. We further suspect that the weak link between research and development as well as resource constraints from the donors and the government could explain resource inadequacy.

To the extent that political friction is rife in collaborative research, we concluded that the strategy formulation and implementation process is political. This is consistent with the arguments advanced by Mintzberg and Quinn (1996); Thompkins (1990) and Pettigrew (1990) amongst others. It would be interesting to find out the prominent 'political games' that are played in these settings. The study showed that implementation of plans takes more time than originally planned and that major obstacles surface during implementation. Although there could be other factors contributing to this, we hypothesize that politics has a role in this.

Coordination costs for running collaborative R&D are very high. There are however acknowledgements that collaboration reduces the costs for undertaking research.

Vision, internal analysis and external analysis are, respectively, the most important features in the strategy formulation and implementation process within collaborative R&D. This is consistent with the strategic management literature (Johnson and Scholes, 2001; Pearce and Robinson 2000).

The study showed that analysis of external environment is weak; coordination and monitoring of implementation is inadequate and that leadership provided is not effective enough. We found that as the complexity of the collaboration increases, definition of key implementation tasks becomes less clear. This is consistent with management literature on organizational behaviour – that organizational inertia tends to creep in as layers in organizational structure increase, (Tsang, 1997).

Research based institutions have not been continuously adapting to change as would be expected. We contend that strategic issue management receives little attention in these settings – an area that might call for further research. The study, for example, found that competing activities and/or crises distract attention from planned activities.

The second objective for the study sought to examine what aspects of strategy formulation and implementation process local personnel play a role in.

The study showed that there is limited involvement of local personnel at the strategic level. Local personnel are conservatively involved in determining resource allocation at the corporate level; developing R&D profile that reflects internal conditions and capabilities; identification of opportunity and risk; selection of long-term objectives as well as the identification of most desirable strategic options. This means that they are excluded from the strategic agenda of participating in the formulation of strategic plans, board of directors' meetings, analysing the external environment, financial resource allocation and management of strategic change. This is particularly the case for international research based institutions. For the local institutions, we found that, with the exception of government

research institutions, donors drive their strategic agenda. This may be attributed to resource constraints, dependency culture, lack of strategic focus and lack of empowerment on the part of the local researchers. Other factors may include weak research regulatory framework and information asymmetries. This implies that local researchers have been sidelined in the global research platform in spite of the fact that benefits arising from research undertaken in the local setting should benefit both the local and foreign stakeholders.

The study also showed that greater involvement of local personnel in identifying the most strategic options would enhance their participation in the analysis of external environment and selection of long-term objectives. Equally, increased participation in the implementation of strategic choices and better engagement in the board of directors' meetings would enhance their contribution in setting the long-term agenda for the R&D settings.

There is a strong relationship between financial resource allocation and management of strategic change. We interpret this to mean that widening the widow for the local personnel to participate in financial resource allocation would greatly enhance their participation in management of strategic change as well as identification of the most strategic options. Theoretical grounds for this are rooted on the resource-based view of strategy (Penrose, 1959) and change management literature (Black, 2002).

We contend that minimal engagement of local personnel in strategy formulation and implementation within the ambit of collaborative R&D has been due to uncoordinated efforts on the strategic research agenda. For example, we identified that within one university, there are numerous pockets of collaborative research. Each pocket undertakes its own research, without clear research policy framework for the university. It is thus difficult to evaluate the effectiveness of such research and how it contributes to the university's research agenda, if any. Without such coordination, research benefits cannot be effectively felt; and the importance of institutional reputation is lost. It is critical that in a bid to strengthen the bargaining muscle on collaborative research arrangements, institutional research is accorded the decorum it deserves.

The third objective of our study sought to determine the factors that influence participation of the local personnel in the strategy formulation and implementation process.

Environmental turbulence, shifts in partner objectives and expectations, heterogeneity of research initiatives, poor communication, complexity of the collaboration and waning managerial attention are factors that negatively impact on the participation of local personnel in the strategy formulation and implementation process.

The study showed that the higher the environmental turbulence, the lesser the local personnel participate in strategy formulation and implementation. It would appear that there are underlying factors that prevent local personnel from effectively absorbing shocks caused by external environment. These could be related to inadequate financial resources and lack of long-term vision. It would however be important to study this area more to find out why this is so and if this is a country-specific problem or one that cuts across a number of developing countries. Porter (1980), Ansoff and McDonnell (1990) amongst others have echoed the importance of external environment in strategic management.

Shifts in partner objectives and expectations result in discontinuation of funding arrangements, thus distracting the local researchers. Clearly articulating the roles and responsibilities of the collaborators and establishing binding agreements could check such vulnerability. In addition, establishing mechanisms on sustaining local research efforts through the establishment of research funds could be desirable.

Heterogeneity of research initiatives can be addressed through better coordination and establishment of research policy framework at both national and institutional levels. It is likely that heterogeneity has been due to lack of coordination and striking absence of a clear research policy framework. Arising from this, myriad of foreign researchers have zoomed in with set research agenda and confused the local researchers. They further seem to have taken advantage of the scarce local talent in collaboration management.

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We contend that capacity on collaboration governance needs to be built for the local researchers so as to address issues on poor communication, management and leadership.

Strikingly, the study showed that differences in technology, clashes in corporate culture and patent problems tend to spur local researchers' participation in the strategy formulation and implementation process. Technological differences could be an incentive for the local researchers to collaborate and hasten their learning process and technology transfer – a reason that was ranked as motivating the establishment of collaborative R&D. We suspect the need to learn could also explain why cultural differences tend to spur participation of local personnel in collaborative research. It would be important to examine why patent problems would be associated with greater participation of local personnel in collaborative research. Sampson (2002) found that technological differences could motivate learning in collaboration. Gulati and Higgins (2003) have also claimed that cultural differences matter in inter-organizational partnerships.

We established that in making efforts to improve strategy formulation and implementation in these settings, some trade-offs are necessary. For example, while increasing the number local personnel involved in selecting long-term objectives and identification of opportunity and risk has the potential of increasing their engagement in the board meetings (an important strategic consideration), this may also reduce their potential in identifying the most desirable strategic options. However, we established that there can be reliable models to determine the key variables to be considered in making strategic interventions in areas such as participation in the board meetings, analysis of external environment, selection of long-term objectives, financial resource allocation, management of strategic change and leading strategic objectives. Thus, depending on the strategic priority, it is possible to improve the strategy formulation and implementation process across these dimensions.

Donor funding in collaborative research settings in Kenya is largely dependent on the presence of expatriate staff. This affects participation of the local personnel in strategy formulation and implementation.

We contend that research-based institutions in Kenya lack clear strategies. There are high levels of friction in these settings as confirmed by our hypotheses. Collaboration governance has been overlooked, and flaws in the structures of these settings have led to poor strategy formulation and implementation. We posit realized strategy in international collaborative R&D settings in Kenya is primarily explained by emergent components rather than planned components of strategy. This has the potential of reducing the impact of realized strategy and negating R&D benefits that should otherwise be realized.

There is no clear cut national strategy on research and development in Kenya, and even the institution that has been mandated to oversee matters on science and technology requires further support from the government in terms of financial resources, personnel and infrastructure. In view of the fact that Kenya is the largest recipient of research funding in the East and Central African region, there is need to urgently have a national policy on research and development. Such a policy should set the national priorities and targets on how to leverage the benefits of R&D as well as how these should spill over to benefit the local people.

In view of the non-cooperative model for R&D, we posit that collaborative research in Kenya is at the end of stage two. We envisage a situation where, in the coming years, foreign collaborators will provide larger spillovers and also risk defection from local research institutions.

5.2   Limitations of the study

In undertaking this study, the following constraints were faced.

i)   This study generalized research institutions and did not cluster the collaborative research settings into sectors. There may be some strategy formulation and implementation issues that are sector-specific. This contextual nature would not be revealed by our study. It is important to bear this in mind when interpreting our findings.

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ii)   Unavailability of information: In some cases, it was not possible to get all the information we required during the interview either because the respondents did not know the answers or because some of the respondents felt that the information was confidential.

iii) Location and misrepresentation: A number of research settings had changed their location within the year the study was undertaken, thus creating difficulties in locating where they were. The researcher was unable to locate two research settings sampled for the study. In addition to this, the researcher encountered some institutions that have ceased their research operations. There were other institutions that had been registered as research oriented, but when approached it turned out that they do not engage in research and had to be dropped from our original sample. This misrepresentation created some difficulties.

iv)   Time: The target respondents to this study were principal researchers and research coordinators. Most of these people have many demands on their time, and their availability is limited. As a result of this, getting the responses took longer than initially envisaged. This was compounded by the fact that the study took place in the summer months of July/August; a time when some of the researchers had proceeded on their home leave.

v)   Finances: Due to lack of adequate financial resources, the study concentrated on collaborative research settings within Nairobi and its environs. Research settings in other parts of the country were omitted.

5.3   Recommendations for further research

Future research should examine context-specific collaborative research. Such studies should, for example, cluster collaborative research settings into sectors such as health, agriculture, industrial and so on. Distinction should also be made between research undertaken in academic institutions (universities for example) and other research institutions.

Future research should examine the following: -

i) Our study showed that most collaborative research settings were established to enhance technology and knowledge transfer. However, there is little evidence on technology transfer. It is important to carry out further research to determine why this is so.

ii) Further research should also examine why increased environmental turbulence deters the local personnel from increased participation in strategy formulation and implementation, and what can be done to reverse this. For example, what factors lead to reduced roles (amongst the local personnel) in financial resource allocation as environmental turbulence increases?

iii) Why collaborative research settings in Kenya have not been responsive enough to changes in the external environment, and how management of strategic change in these settings can be enhanced.

iv) Factors that contribute to clustering of collaborative research initiatives around large research-based institutions.

v) Further research should also study collaborative research settings as knowledge networks, with a view to investigating how this process takes place, answering questions such as: At what point does fission within collaborative R&D take place?

vi) It would be important to undertake longitudinal studies in future to find out factors that affect local personnel involvement in strategy formulation and implementation within research settings in Kenya, and how these change over time.

5.4 Recommendations for Policy and Practice

In order to improve strategy formulation and implementation in research-based institutions, we recommend that:-

i) A national policy on research and development should be established. The policy should set the national priorities and targets on R&D and spell out ways and means of leveraging the benefits of R&D as well as how these should spill over to the local people. This is an urgent issue that needs to be addressed by the government. In addition, the government needs to increase its capacity in assessing changes in global policies on R&D and its responsiveness to this.

ii) Research based institutions should start to lobby the government to pass a bill on biotechnology without undue delays. Some considerations in this bill should be that research questions that are addressed by researchers should be pertinent to the local setting and that collaborative research should clearly spell out how the benefits from research will be shared between the local institutions and the foreign collaborators.

iii) Local research institutions should advocate for the establishment or increase in budget allocation for research and development. Universities should take a lead in this.

iv) Universities should develop a clear R&D policy framework to demonstrate how they will lead the country's R&D agenda.

v) A research fund should be established so that there is stable funding for sustaining key research in future. Parliament should pass a bill to establish the research fund.

vi)   Further investments in collaborative research management should be put in place. These investments include capacity building for local personnel; financial resources and infrastructure for research. Capacity building in R&D management and coordination should target areas such as strategy development, coordination of collaborative networks, organizational development and management of strategic change. This would lead to better understanding of roles and responsibilities of the various collaborators, mutual respect, more clear guidelines on conflict resolution, improved communication and better time-lines for R&D implementation. Infrastructure for research should target, *inter-alia*, equipment and communication. These efforts would, in the short-term, require increased incentives for partnerships from the development partners.

vii) Better policy and executive direction within research institutions should be developed. In designing the R&D policies, it is imperative that professionals with good understanding of strategic management and policy issues be engaged. These policies should make realistic demands on people's time.

viii) Sustainability of local research institutions needs to be given priority. An important consideration in this is the need to enhance collaboration amongst local institutions as well as enhance collaboration between south-south research-based organizations. This has the added advantage of increasing the political will to support research in Kenya and the region. This would be a timely move in view of the economic convergence currently taking place.

ix)   Issues on partnership equity need to be given serious consideration. Currently, there are inequities - with foreign collaborators benefiting more from collaborative research. These should be addressed by engaging the local researchers more in decision making; clearly spelling out terms of collaboration and benefit sharing from the onset; increasing the level of involvement of local researchers at all levels; increasing the involvement of

local personnel and other local stakeholders in key positions; carrying out quantitative analysis of stakeholder inputs and empowerment of local stakeholders.

x)   Monitoring of implementation of R&D strategy should be enhanced. Clear milestones for activities to be implemented need to be designed. Monitoring and evaluation mechanisms need to be taken into account when engaging in research, and these should be clearly specified.

xi) Documentation of lessons learnt during the research process needs to be enhanced. This is particularly important so that researchers avoid re-inventing the wheel. In addition, dissemination of research results should be strengthened and improved. The results need to be shared with local stakeholders including research subjects. Regular fora for interaction amongst the collaborators should be established. These fora should consider sufficient time for discussions.

xii) A stronger link between research and development needs to be forged. Currently, there is a disconnect between these two. There is also a disconnect between research and policy. Some realignment between research, development and policy requires urgent attention from research-based institutions. This realignment would enhance the productive capacity of R&D and financial position of the research settings in Kenya.

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Henry Waruhiu

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E-Mail : HWaruhiu@hotmail.com

Appendix 1 - Letter of introduction

July 26, 2004

Dear Respondent,

RE: MBA RESEARCH PROJECT
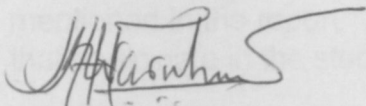
I am a student at the University of Nairobi undertaking a Masters of Business Administration (MBA) programme. The final part of the programme requires the student to undertake a research project based on an area that affects business organizations in Kenya. My study is on strategy formulation and implementation in international collaborative research and development settings in Kenya.

Your organization has been randomly selected to participate in this study. The questionnaire to be used for data collection is attached herewith. This is divided into four sections: General information, strategy formulation and implementation, participation of local personnel in strategy formulation and implementation and availability of donor support. The questionnaire will take approximately thirty minutes to complete.

The information obtained will be used for academic purposes only and will be treated in strict confidence and in no instance will your name (or that of your organization be mentioned in the report. I would request that you answer the questions as honestly as possible.

Your participation and cooperation is greatly appreciated.

Yours Sincerely,

Waruhiu Henry
MBA Student

UNIVERSITY OF NAIROBI
FACULTY OF COMMERCE
MBA PROGRAMME – LOWER KABETE CAMPUS

Telephone: 732160 Ext. 208
Telegrams: "Varsity", Nairobi
Telex: 22095 Varsity

P.O. Box 30197
Nairobi, Kenya

Appendix 1b – Letter of Introduction

July 22, 2004

TO WHOM IT MAY CONCERN

Dear Respondent,

RE: MBA RESEARCH PROJECT – WARUHIU, H.K., (D61/P/8571/00)
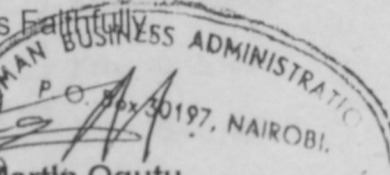
This is to confirm that the above named is a student in the Faculty of Commerce, University of Nairobi pursuing studies leading to the award of Masters In Business Administration (MBA) degree. The final part of the programme requires the student to undertake a research project based on an area that affects organizations in Kenya as part of the coursework assessment. This student will look at issues in strategy formulation and implementation in research based institutions in Kenya.
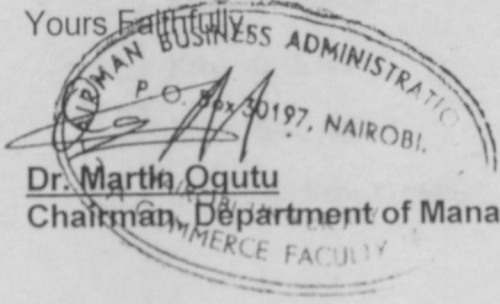
Your organization has been selected to participate in this study. The information obtained will be used for academic purposes only and will be treated in strict confidence and in no instance will your name (or that of your organization be mentioned in the report. A copy of the final report will be availed to the organizations that participate in the study on request.

We would appreciate if you could provide the student with the data and information he needs to collect.

Thank you.

Yours faithfully,

Dr. Martin Ogutu
Chairman, Department of Management

STUDY QUESTIONNAIRE

Appendix 2

QUE# ☐   RESP# ☐   RESPID ☐

Section I - General Information

1. Name of the Research and Development (R&D) Setting ....

2. Title of the respondent ....

3. E-Mail Address ....

4. How many years have you been employed in this R&D setting? ....

5. How many years ago was the R&D setting established? .... Years

6. How many Kenyan employees do you have ....

7. Briefly describe the nature of R&D undertaken by the international collaborative R&D setting

    ....

    ....

    ....

    ....

    ....

8. What is your annual budget for internal R&D?

    ☐ Below Kshs One Million

    ☐ Kshs1-4 Million

    ☐ Kshs 4-8 Million

    ☐ Kshs 8-12 Million

    ☐ More than Kshs 12 Million

9. What is your overall annual budget? *(Please tick one)*.

    ☐ Below Kshs. 5 million

    ☐ Kshs5-10 Million

    ☐ Kshs 10-15 Million

    ☐ Kshs 15-20 Million

    ☐ More than Kshs20 Million

10. What was the main motivation for establishing your collaborative R&D setting?

    ☐ Institutional renewal

    ☐ To attract research funding

    ☐ Technology and knowledge transfer

    ☐ Other *(Please specify)*

Section II – Strategy Formulation and Implementation

11. Does your R&D setting have a vision?

    ☐ Yes

    ☐ No

    (If your answer is 'No', please go to question 14)

12. Briefly describe how the vision was developed and state the people who were involved.

    ....

    ....

    ....

    ....

13. How would you rate the clarity of the vision for your R&D setting?

    ☐ Very clear

    ☐ Clear

    ☐ Unclear

    ☐ Very unclear

14. Does your R&D setting have a Mission statement?

    ☐ Yes

    ☐ No

    (If your answer is 'No', please go to question16)

15. Who developed the Mission statement?

    ☐ The Chief Executive Officer

    ☐ Senior Management

    ☐ Senior Management, Staff and Other Stakeholders

    ☐ Board of Directors

    ☐ Others *(Please specify)*

16. Are you familiar with the strategy formulation and implementation process?

    ☐ Yes

    ☐ No

17. Do you have a strategic plan?

    ☐ Yes

    ☐ No

    (If your answer to question 16 and/or 17 above is 'No', please go to question 22)

18. Is your strategic plan

    ☐ Formal?

    ☐ Informal?

19. What is the duration of your strategic plan? .... Years

20. How would you rate the importance of each of the following in so far as strategy formulation and implementation is concerned?

    1 = Not Important   7 = Very Important

		1	2	3	4	5	6	7
i)	Vision							
ii)	Mission							
iii)	Values							
iv)	Organizational Structure							
v)	Systems							
vi)	Culture							
vii)	Power							
viii)	Politics							
ix)	Internal analysis							
x)	External analysis							

21. To what extent is strategy formulation and implementation in your R&D setting characterized by the following features?

1 = Not at all   5= To a very great extent

		1	2	3	4	5
a)	R&D Collaboration increases the local researchers international reputation					
b)	Attaining strategic and operational benefits from collaborative R&D is marked by severe political friction (internal conflicts) among participating organizations					
c)	R&D collaboration mainly advances foreign policy objectives					
d)	Firms which spend more on internal R&D have a significantly higher probability of cooperation in R&D					
e)	R&D Collaboration reduces the costs for undertaking research.					
f)	Patent rights arising from research are equally shared between the parent organizations					
g)	Coordination costs of running the collaborative R&D are very high					
h)	Governance structures for collaborative R&D are inefficient.					
i)	Foreign collaborators dominate the strategy formulation and implementation process undertaken in the host (local) R&D setting					
j)	Collaborative R&D sharpens the competitive edge of organizations					
k)	The Government needs to be involved in establishing incentives for collaborative R&D					
l)	Collaborative R&D increases the funding level for the researchers					
m)	There is scarce local talent in collaboration management					
n)	Benefits of international collaborative R&D are geared towards benefiting the foreign researchers more					

Section III - Participation of local personnel

22. How many local and expatriate personnel are involved in each of the following?

	Attribute	No. of local personnel involved	No. of expatriate staff
i)	Board of directors meetings		
ii)	Identification of opportunity and risk at the corporate level		

iii)	Determining resource allocation at corporate level			
iv)	Formulating the mission of the R&D setting, purpose, philosophy and the goals of the R&D setting			
v)	Developing the R&D profile that reflects internal conditions and capabilities			
vi)	Analysis of the external environment			
vii)	Analyzing the options of the R&D setting by matching its resources with the external environment			
viii)	Identifying the most desirable strategic options			
ix)	Selecting long-term objectives			
x)	Developing annual objectives and short-term strategies			
xi)	Implementing strategic choices			
xii)	Financial resource allocation			
xiii)	Management of strategic change			
xiv)	Leading strategic initiatives			

23. To what extent does each of the following factors affect the participation of local personnel in your setting? *(Put a tick in the third column if the factor applies to your setting and leave blank if it does not. For the items you place a tick on, please indicate the value 1-5 that applies).*

1 = Not at all   5 = To a very great extent

		Tick	1	2	3	4	5
i)	Shifts in partners' objectives and expectations						
ii)	Waning managerial attention						
iii)	Clashes in corporate culture						
iv)	Poor communication						
v)	Complexity of the collaboration						
vi)	Environmental turbulence						
vii)	Lack of clarity on which parent to be answerable to						
viii)	Size differences amongst partners						
ix)	Differences in technology amongst partners						
x)	Patent problems						

xi)	Heterogeneity of research initiatives						
xii)	Others *(Please specify)*						

24. Please rate the level of involvement in developing the organization's strategic plan for the following categories of people.

	0-20%	21-40%	41-60%	61-80%	81-100%
Local staff					
Expatriate staff					
Key stakeholders					
Board of Directors					
Donors					

25. How many expatriate staff do you have in your setting?
(Please note that the term 'expatriate' is used to denote foreign staff who are not Kenyans even though they might be from an African country)

.... Volunteers

.... Employed

Section IV – Availability of donor support

26. Does your R&D setting receive financial support from donors?

☐ Yes

☐ No

27. What level of funding is dependent on the presence of the expatriate staff in your R&D setting?

☐ 0-20%

☐ 21-40%

☐ 41-60%

☐ 61-80%

☐ 81-100%

28. To what extent does the donor financial support for the local collaborative R&D settings depend on the following factors?

1= Not at all   7= To a very great extent

		1	2	3	4	5	6	7
i)	Nationality of the lead researcher							
ii)	Nationality of the foreign parent							
iii)	Number of years the lead researcher has served in the							

	collaborative R&D setting							
iv)	Number of expatriate staff in senior management level							
v)	Asset base for the local parent							
vi)	Reputation of the collaborative setting							
vii)	Assertiveness of the senior-most local researcher							
viii)	Title of the senior-most local researcher							
ix)	Number of years the lead researcher has served in the R&D setting							
x)	Number of years the senior-most local researcher has served in the R&D setting							
xi)	Number of local personnel in senior management levels							

29. Who are your collaborators? *(Please rank them in order of priority using the following criteria: financial support, expertise and technology. For each priority, please tick the criteria that best describes your choice).*

    1. ………………………………… (Financial support, Expertise, Technology)
    2. ………………………………… (Financial support, Expertise, Technology)
    3. ………………………………… (Financial support, Expertise, Technology)
    4. ………………………………… (Other. Please specify)

30. On what basis are collaborators chosen in your R&D setting?

    ☐ Financial capability of the collaborating institution

    ☐ Knowledge Transfer

    ☐ Asset Base

    ☐ Commonness in Mission statement and Objectives

    ☐ Organizational Structure

    ☐ Superior Technology

    ☐ Array of products and services being offered by the collaborator

    ☐ Other *(Please specify)*

31. Are the contributions of collaborating institutions to your R&D setting well specified in advance?

    ☐ Yes

    ☐ No

32. Are the partner outcomes clearly articulated?

- ☐ Yes
- ☐ No

33. How would you describe your business environment?

- ☐ Stable
- ☐ Fairly stable
- ☐ Unstable
- ☐ Turbulent
- ☐ Fairly Turbulent
- ☐ Very Turbulent
- ☐ Other (Please specify)

34. How would you rate the complexity of the work undertaken by your R&D setting?

- ☐ Very complex
- ☐ Complex
- ☐ Fairly complex
- ☐ Not complex

35. Which of the following factors best explains your answer above?

- ☐ Political Environment
- ☐ Economic Environment
- ☐ Technological Environment
- ☐ Cultural and Social Environment

36. How would you rate your R&D setting in terms of the following attributes?

Attribute	Excellent	Very Good	Good	Fair	Other (Please specify)
Reputation					
Know-how and skills					
Trust by collaborators					
Leadership excellence					
Innovation					
Financial resources					
Corporate social responsibility					

37. Who determines the suitability, feasibility and selection of the strategic options that are evolved in your R&D setting?

	Suitability	Feasibility	Selection
Chief Executive Officer			
Top Management Team			
Middle Management Team			
Low Level Employees			
Key customers			
All the above			

38. Please assess the strategy implementation process in your setting based on the factors indicated in the second column.

1 = Do Not Agree   7 = Strongly Agree

	Strategy Implementation parameter	1	2	3	4	5	6	7
i)	Implementation of plans takes more time than originally planned.							
ii)	Major obstacles surface during implementation than initially envisaged.							
iii)	Coordination of implementation activities is not effective enough.							
iv)	Competing activities and/or crises distract attention from planned activities.							
v)	Environmental factors, which cannot be controlled, distort the implementation process.							
vi)	Leadership and direction provided is not adequate.							
vii)	Key implementation tasks are not clearly defined.							
viii)	Monitoring of implementation is not adequate.							
ix)	Strategic decision being implemented is not good.							
x)	Other collaborators do not see the strategic decision as important.							
xi)	Resources made available for implementation are not adequate.							

39. R&D Management can be categorized into four broad categories.

a) Biological – Where R&D Management must adapt continuously to change;

b) Chaotic – Where R&D is complex and variable and there are limits of manageability and where no planning in detail is conducted;

c) Deterministic – Where the situation changes over time and logic, reason and methods of measuring R&D outputs are prevalent;

d) Empirical - Where rules can be found that apply most of the time.

(Please circle the category that most appropriately represents R&D management in your setting).

40. What suggestions/recommendations do you have on how strategy formulation and implementation in international collaborative R&D can be improved?

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41. Any other comment

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Thank you for your time and patience.
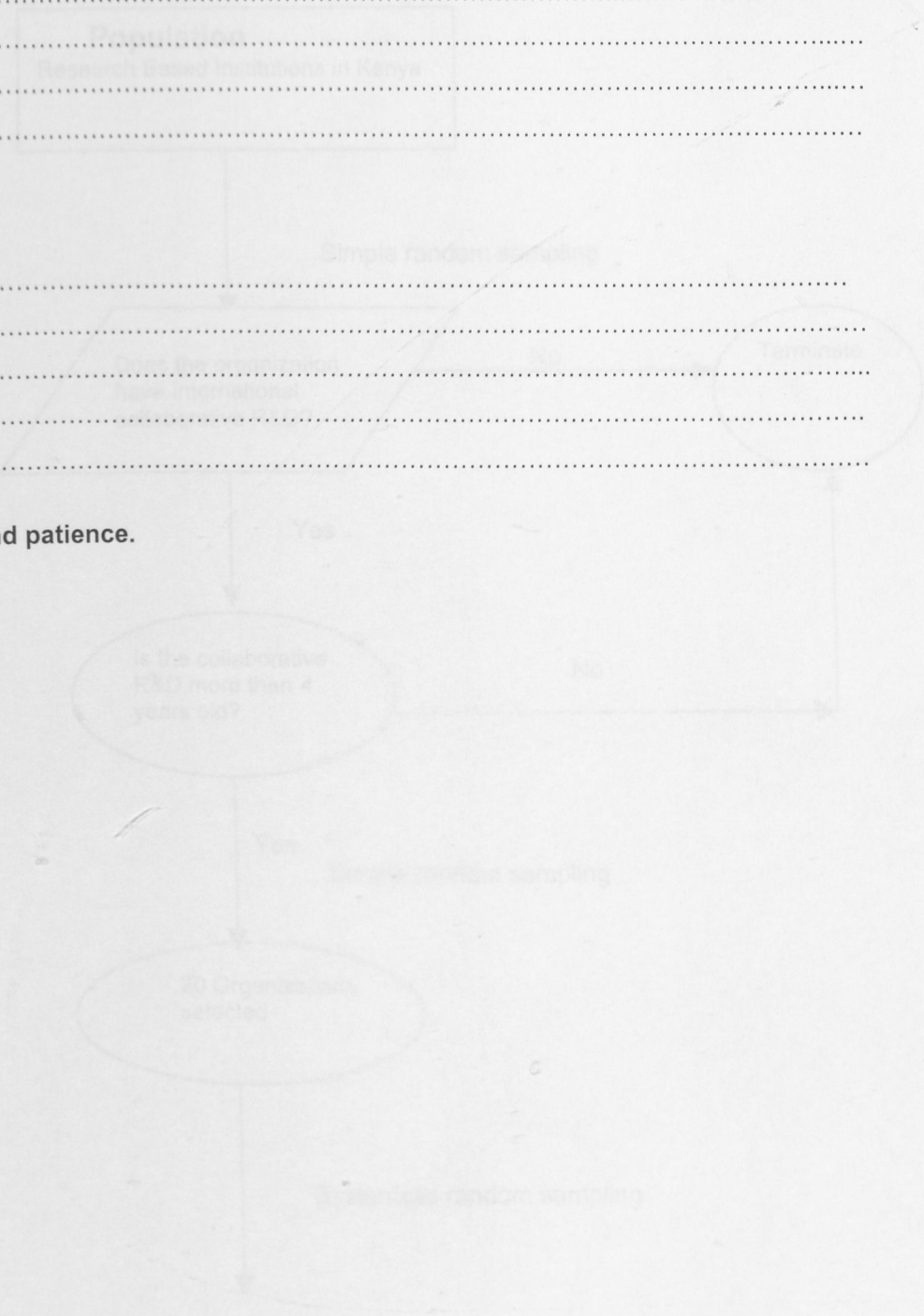
Appendix 3: Sampling Plan - Organizations

Population
Research Based Institutions in Kenya

Simple random sampling

Does the organization have international collaborative R&D?

No

Terminate

Yes

Is the collaborative R&D more than 4 years old?

No

Yes

Simple random sampling

20 Organizations selected

Systematic random sampling
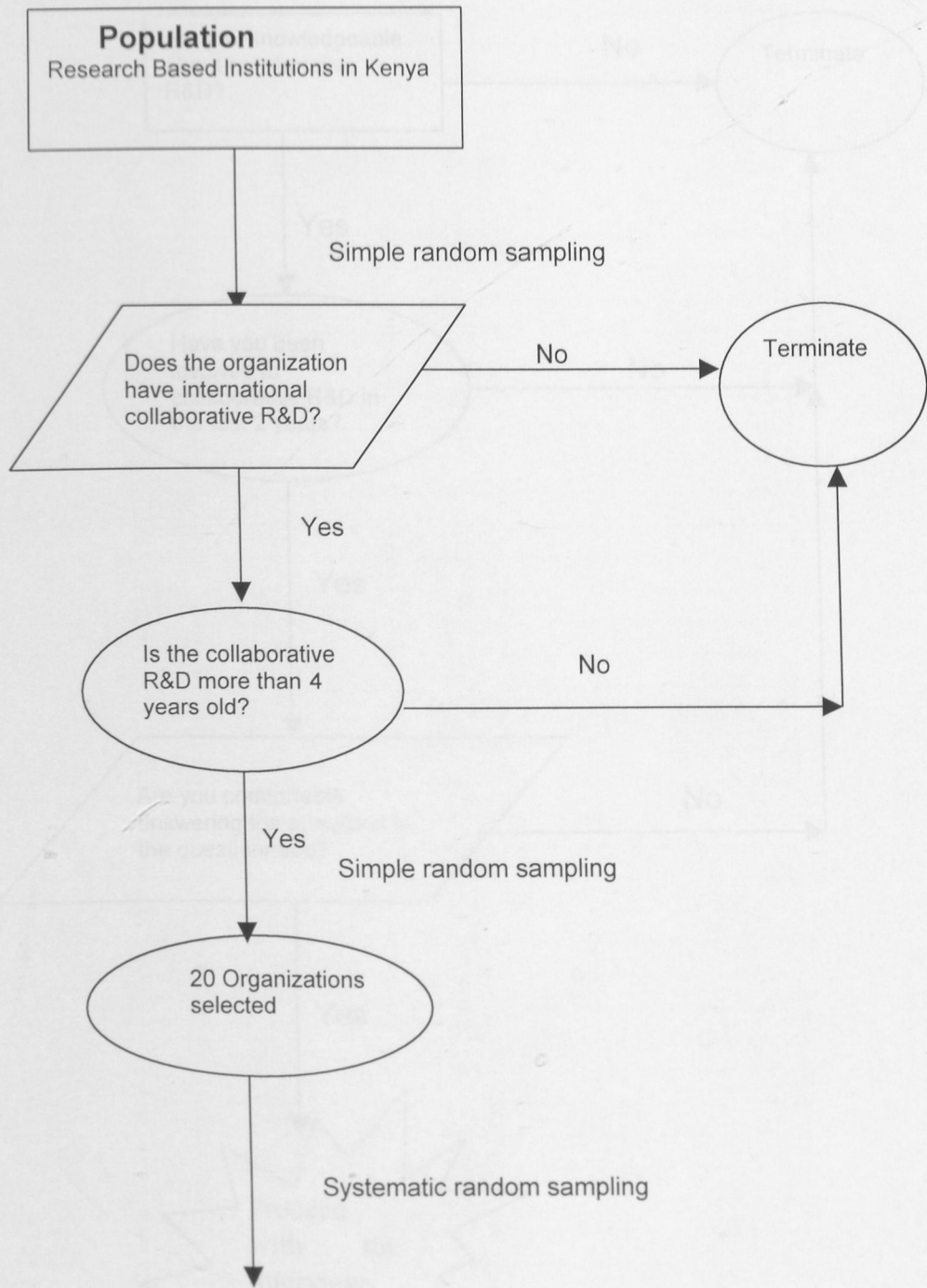
Appendix 4: Sampling Plan - Respondents

```
┌─────────────────────┐
│ Are you knowledgeable│      No
│ about collaborative  │──────────────►  (Terminate)
│ R&D?                 │
└─────────────────────┘
          │ Yes
          ▼
    ╱Have you been╲           No
   ( involved in    )──────────────►
    ╲collaborative R&D╱
     ╲in the last 2 years?╱
          │ Yes
          ▼
   ╱Are you comfortable╲      No
  ╱ answering the questions ╲────►
  ╲ in the questionnaire?   ╱
          │ Yes
          ▼
      ✶ Proceed with the interview ✶
```
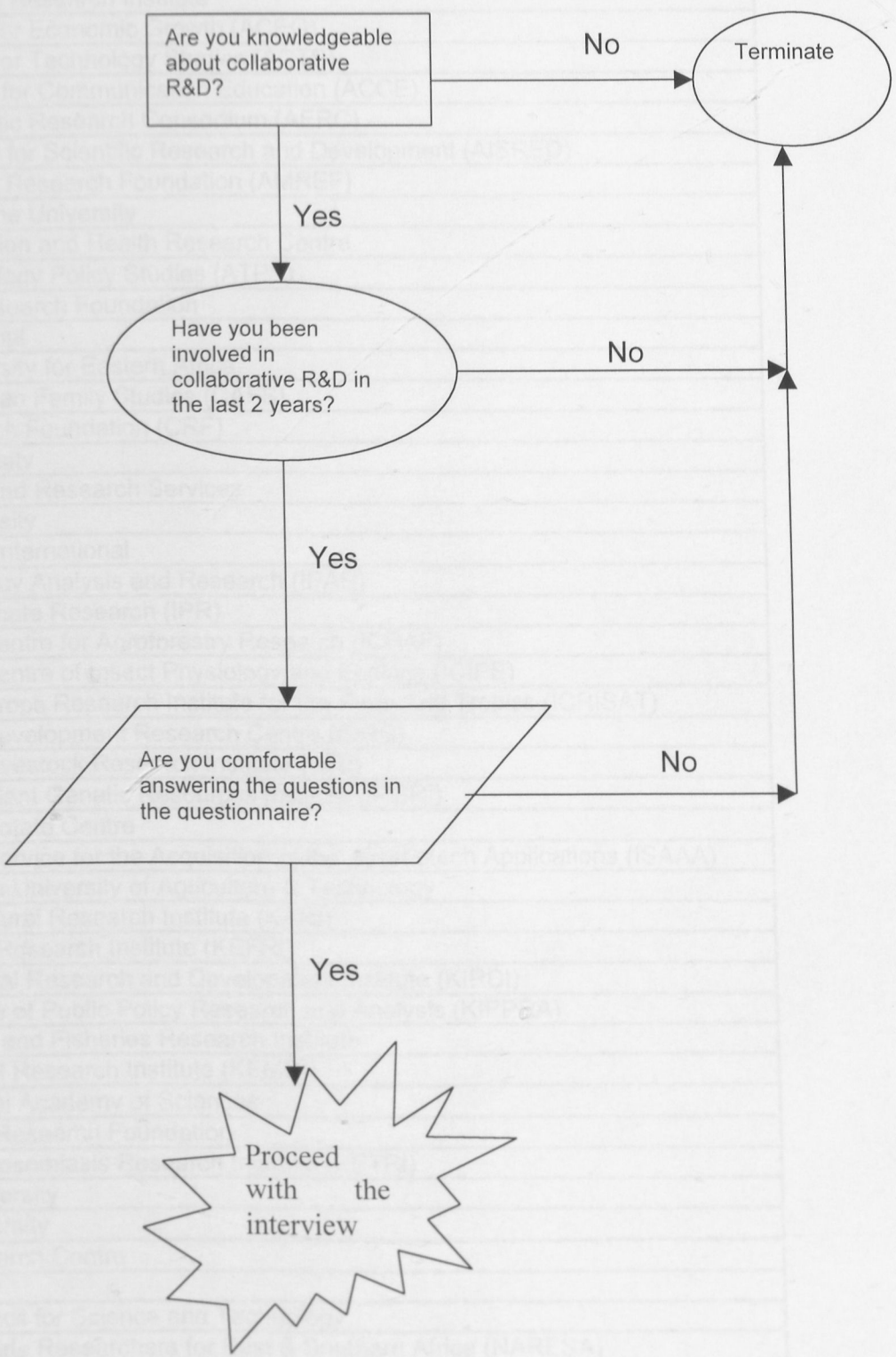
Appendix 5 - Study Population

1	African Academy of Sciences
2	African Butterfly Research Institute
3	African Centre for Economic Growth (ACEG)
4	African Centre for Technology Studies (ACTS)
5	African Council for Communication Education (ACCE)
6	African Economic Research Consortium (AERC)
7	African Institute for Scientific Research and Development (AISRED)
8	African Medical Research Foundation (AMREF)
9	African Nazarene University
10	African Population and Health Research Centre
11	African Technology Policy Studies (ATPS)
12	Agricultural Research Foundation
13	CAB International
14	Catholic University for Eastern Africa
15	Centre for African Family Studies (CAFS)
16	Coffee Research Foundation (CRF)
17	Daystar University
18	Development and Research Services
19	Egerton University
20	Family Health International
21	Institute of Policy Analysis and Research (IPAR)
22	Institute of Primate Research (IPR)
23	International Centre for Agroforestry Research (ICRAF)
24	International Centre of Insect Physiology and Ecology (ICIPE)
25	International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
26	International Development Research Centre (IDRC)
27	International Livestock Research Institute (ILRI)
28	International Plant Genetic Resources Institute (IPGRI)
29	International Potato Centre
30	International Service for the Acquisition of the Afri-Biotech Applications (ISAAA)
31	Jomo Kenyatta University of Agriculture & Technology
32	Kenya Agricultural Research Institute (KARI)
33	Kenya Forest Research Institute (KEFRI)
34	Kenya Industrial Research and Development Institute (KIRDI)
35	Kenya Institute of Public Policy Research and Analysis (KIPPRA)
36	Kenya Marine and Fisheries Research Institute
37	Kenya Medical Research Institute (KEMRI)
38	Kenya National Academy of Sciences
39	Kenya Sugar Research Foundation
40	Kenya Trypanosomiasis Research Institute (KETRI)
41	Kenyatta University
42	Maseno University
43	Medical Research Centre
44	Moi University
45	National Council for Science and Technology
46	Network for Aids Researchers for East & Southern Africa (NARESA)
47	Research Management and Policy Analysis Institute
48	Tea Research Foundation of Kenya
49	United States International University
50	University of Eastern Africa, Baraton
51	University of Nairobi
52	Wellcome Trust Research Laboratories

Note: Universities that had not been chartered by 2004 were not included in determining the study population

Appendix 6 – Sample Clearance Letter from Institution X

4th August, 2004

Dr. Mario Herrero
Dr. Bruno Minjauw
Dr. Steve Staal
Dr. Edward Rege
Dr. Shirley Tarawali

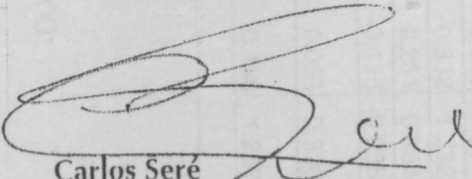**RE: MBA Research project on strategy formulation and implementation in international research and development setting in Kenya**

We have allowed Henry Waruhiu an MBA Student at the University of Nairobi to collect data and information for the above research project. This will involve answering a short questionnaire.

Please accord him your full cooperation.

Regards,

Carlos Seré
Director General

Appendix 7 - Importance of various strategy formulation & implementation parameters

Appendix 7a: Importance of various strategy formulation & implementation parameters - Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.745	0.555	0.447	0.206	0.555	5.160	7	29	0.001

Appendix 7b: Importance of various strategy formulation & implementation parameters - Coefficients

Model	Strategy form. & implementation parameter	Unstandardized Coefficients		Std. Coeff.	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.654	0.180		9.202	0.000	1.286	2.021					
	Vision	-0.091	0.033	-0.571	-2.772	0.010	-0.159	-0.024	-0.687	-0.458	-0.343	0.362	2.760
	Culture	-0.001	0.020	-0.010	-0.071	0.944	-0.042	0.039	-0.381	-0.013	-0.009	0.732	1.365
	Internal analysis	-0.048	0.039	-0.332	-1.232	0.228	-0.127	0.031	-0.564	-0.223	-0.153	0.212	4.721
	External analysis	0.039	0.049	0.251	0.804	0.428	-0.060	0.139	-0.550	0.148	0.100	0.158	6.329
	Scarce local talent in collaboration management	-0.020	0.023	-0.116	-0.856	0.399	-0.067	0.027	-0.343	-0.157	-0.106	0.837	1.194
	Operational benefits marked by severe political friction	0.010	0.032	0.053	0.320	0.751	-0.056	0.076	-0.076	0.059	0.040	0.558	1.793
	Resources made available for implementation are not adequate	0.023	0.019	0.196	1.207	0.237	-0.016	0.063	0.376	0.219	0.150	0.580	1.723
a	Dependent Variable: do you have a strategic plan												

Appendix 8: Features of strategy formulation and implementation

Appendix 8a: Features of strategy formulation & implementation - ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	1.91	6	0.32	6.18	0.0002
	Residual	1.69	33	0.05		
	Total	3.6	39			

Appendix 8b: Features of strategy formulation & implementation - Coefficients

Model	Strategy form. & implementation parameter	Unstd. Coefficients		Std. Coeff.	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.660	0.105		15.857	0.000	1.447	1.873					
	Operational benefits marked by severe political friction	0.021	0.032	0.100	0.650	0.520	-0.045	0.087	-0.175	0.112	0.078	0.599	1.669
	Collaboration mainly advances foreign policy objectives	-0.012	0.035	-0.053	-0.337	0.739	-0.082	0.059	-0.356	-0.058	-0.040	0.579	1.727
	Collaboration reduces the costs for undertaking research	-0.081	0.026	-0.423	-3.133	0.004	-0.134	-0.028	-0.538	-0.479	-0.374	0.782	1.279
	Coordination costs of running collaboration are very high	-0.069	0.027	-0.351	-2.569	0.015	-0.124	-0.014	-0.500	-0.408	-0.307	0.766	1.305
	Governance structures for collaboration are inefficient	-0.056	0.031	-0.242	-1.810	0.079	-0.118	0.007	-0.461	-0.300	-0.216	0.797	1.255
	Foreign collaborators dominate strategy formulation & implementation	-0.009	0.032	-0.047	-0.291	0.773	-0.075	0.056	-0.289	-0.051	-0.035	0.553	1.807
a	Dependent Variable: do you have a strategic plan												

Appendix 9 – Importance of organizational structure

Appendix 9a: Importance of organizational structure - Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.83	0.69	0.59	1.41	0.69	6.95	9	28	3.27E-05

Appendix 9b: Importance of organizational structure - Coefficients

Model	Strategy form. & impl. parameter	Unstd. Coeff. B	Std. Error	Std. Coeff. Beta	t	Sig.	95% Confidence Interval for B Lower Bound	Upper Bound	Correlations Zero-order	Partial	Part	Collinearity Statistics Tolerance	VIF
1	(Constant)	-0.445	0.923		-0.482	0.633	-2.335	1.445					
	Vision	0.005	0.406	0.004	0.011	0.991	-0.828	0.837	0.550	0.002	0.001	0.111	9.015
	Mission	-0.262	0.334	-0.207	-0.785	0.439	-0.947	0.422	0.482	-0.147	-0.082	0.158	6.312
	Values	0.488	0.228	0.447	2.146	0.041	0.022	0.954	0.693	0.376	0.225	0.255	3.929
	Systems	-0.166	0.152	-0.186	-1.093	0.284	-0.478	0.146	0.518	-0.202	-0.115	0.382	2.621
	Power	0.362	0.179	0.391	2.026	0.052	-0.004	0.729	0.598	0.358	0.213	0.297	3.368
	Politics	0.053	0.168	0.054	0.318	0.753	-0.290	0.397	0.514	0.060	0.033	0.382	2.620
	Internal analysis	0.400	0.288	0.348	1.390	0.175	-0.190	0.990	0.565	0.254	0.146	0.177	5.662
	External analysis	-0.009	0.348	-0.007	-0.026	0.980	-0.722	0.704	0.506	-0.005	-0.003	0.144	6.953
	Culture	0.214	0.210	0.195	1.022	0.315	-0.215	0.643	0.621	0.190	0.107	0.305	3.281

a Dependent Variable: importance of organizational structure on strategy formulation and implementation

Appendix 10: Involvement of local personnel in analyzing external environment

Appendix 10a: Involvement of local personnel in analyzing external environment - Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	1.00	1.00	0.99	1.62	1.00	529.32	13	24	3.32E-26

Appendix 10b: Involvement of local personnel in analyzing external environment - ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18051	13	1389	529	3.32E-26
	Residual	63	24	3		
	Total	18114	37			

Appendix 11: Local personnel involvement in leading strategic initiatives

Appendix 11a: Local personnel involvement in leading strategic initiatives - Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	1.00	0.99	0.99	2.37	0.99	249.70	13	24	2.56E-22

Appendix 11b: Local personnel involvement in leading strategic initiatives - Coefficients

Model	Functions local personnel get involved in	Unstd. Coeff.		Std. Coeff.	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-0.568	0.612		-0.927	0.363	-1.832	0.696					
	Identification of opportunity and risk at the corporate level	0.172	0.183	0.040	0.937	0.358	-0.207	0.550	-0.072	0.188	0.016	0.167	6
	Determining resource allocation at corporate level	-0.128	0.182	-0.020	-0.707	0.486	-0.503	0.246	-0.045	-0.143	-0.012	0.396	3
	Formulating the mission, purpose, philosophy and goals of the R&D setting	0.363	0.264	0.366	1.373	0.182	-0.182	0.908	0.960	0.270	0.024	0.004	232
	Developing R&D profile that reflects internal conditions n capabilities	-0.258	0.267	-0.259	-0.968	0.343	-0.809	0.292	0.964	-0.194	-0.017	0.004	234
	Analyzing the options of R&D setting by matching its resources with external environment	0.139	0.218	0.139	0.635	0.532	-0.312	0.590	0.987	0.128	0.011	0.006	156
	Identifying the most desirable strategic options	-0.092	0.544	-0.092	-0.170	0.867	-1.216	1.031	0.987	-0.035	-0.003	0.001	954
	Developing annual objectives n short term strategies	-0.136	0.242	-0.135	-0.560	0.581	-0.636	0.365	0.969	-0.113	-0.010	0.005	190
	Implementing strategic choices	-0.233	0.175	-0.232	-1.333	0.195	-0.593	0.128	0.965	-0.262	-0.023	0.010	99
	Board of directors meeting	0.048	0.147	0.014	0.324	0.749	-0.255	0.351	-0.072	0.066	0.006	0.161	6
	Analysis of external environment	0.177	0.296	0.176	0.597	0.556	-0.435	0.788	0.986	0.121	0.010	0.004	283
	Selecting long-term objectives	0.236	0.449	0.234	0.525	0.604	-0.691	1.163	0.987	0.107	0.009	0.002	648
	Financial resource allocation	0.540	0.292	0.539	1.852	0.076	-0.062	1.143	0.991	0.354	0.032	0.004	276
	Management of strategic change	0.267	0.307	0.266	0.870	0.393	-0.367	0.901	0.991	0.175	0.015	0.003	306
a	Dependent Variable: Local personnel in leading strategic initiatives												