

**STRATEGIC ENTREPRENEURSHIP AND COMMERCIALIZATION OF AGRI-
BIOTECHNOLOGY CROP INNOVATIONS IN SELECTED ORGANIZATIONS
IN NAIROBI CITY COUNTY, KENYA**

BY

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**A RESEARCH PROJECT SUBMITTED TO THE SCHOOL OF BUSINESS,
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DECLARATION

This research project is my original work and has not been presented for a degree or other award in any other university.

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D53/OL/HEP/20295/2022

I confirm that the work in this research project was done by the candidate under my supervision.

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DEDICATION

I dedicate this research project to my wife, Elvinah Akinyi, and my daughter, Adelaide Ariella Kodiwo, for their love and patience with me during my studies. I dedicate it to my late dad for teaching me the value of education and inspiring me to scale new academic heights. Your memory brings me joy as I pursue this research project. I also dedicate it to my beloved mum, whose unwavering support and resilience have been a constant source of strength.

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ABBREVIATIONS AND ACRONYMS

| | |
|---------------|---|
| AATF | African Agricultural Technology Foundation |
| ASTGS | Agricultural Sector Transformation and Growth Strategy |
| CBD | Convention on Biological Diversity |
| CIMMYT | International Maize and Wheat Improvement Centre |
| CPB | Cartagena Protocol on Biosafety |
| GDP | Gross Domestic Product |
| GM | Genetically Modified |
| GOK | Government of Kenya |
| ICIPE | International Centre of Insect Physiology and Ecology |
| IPPC | International Plant Protection Convention |
| ISAAA | International Service for the Acquisition of Agri-biotech Applications |
| JKUAT | Jomo Kenyatta University of Agriculture and Technology |
| KALRO | Kenya Agricultural and Livestock Research Organization |
| KARI | Kenya Agricultural Research and Innovations |
| KEBS | Kenya Bureau of Standards |
| KEMRI | Kenya Medical Research Institute |
| KEPHIS | Kenya Plant Health Inspectorate Service |
| KIPI | Kenya Industrial Property Institute |
| KIRDI | Kenya Industrial Research and Development Institute |

| | |
|--------------------|--|
| KNBS | Kenya National Bureau of Statistics |
| LMOs | Living Modified Organisms |
| MAPCC | Malawi Agricultural Productivity and Commercialization Conference |
| MMUST | Masinde Muliro University of Science and Technology |
| MoEF&CC | Ministry of Environment, Forestry and Climate Change, India |
| NBA | National Biosafety Authority |
| NBA | National Biosafety Authority |
| NEMA | National Environment Management Authority |
| PCPB | Pest Control Products Board |
| R&D | Research and Development |
| TUK | Technical University of Kenya |
| WTO | World Trade Organization |

OPERATIONAL DEFINITION OF TERMS

| | |
|---|---|
| Agri-biotechnology | These are modern techniques of improving the genetic makeup of crops, focusing on the development of improved varieties better suited to survive both biotic and abiotic stresses, and which lead to improved crop yields. |
| Commercialization | It is the process by which firms introduce and market the approved Agri-biotechnology innovations through patents and licenses to generate income and, ultimately, a return on investment. |
| Entrepreneurial Culture | It is the shared values, skills, policies, and procedures within an organization that encourage invention, innovation, and risk-taking in pursuit of Agri-biotechnology research and development. |
| Strategic Entrepreneurial Leadership | These are a set of leadership positions, role models, and leadership support activities that promote the pursuit, exploitation, and commercialization of Agri-biotechnology innovations within the rapidly changing organizational environment. |
| Strategic Entrepreneurial Mindset | It is a set of attitudes, perceptions, motivations, and ways of thinking that seek to prospect and capitalize on new |

opportunities in the Agri-biotechnology industry to gain and maintain a competitive edge over other industry players.

Strategic

It is a set of actions taken by private firms and government

Entrepreneurship

institutions to identify and capitalize on new opportunities that lead to the development and commercialization of Agri-biotechnology innovations.

Strategic Resource

It is how an organization uses the available funds, human

Management

capital, knowledge, strategic partners, and networks to pursue opportunities in the Agri-biotechnology industry to commercialize its innovations and stay ahead of other players within the industry.

ABSTRACT

Commercialization is the process of translating ideas into product development using technology to release the products into the market. Despite the huge potential presented by Agri-biotechnology crop innovations, there has been limited commercialization of these innovations in the Kenyan market. The government has taken several steps to support the growth of Agri-biotechnology crop research and development. The Kenya National Biotechnology Development Policy was developed in 2006, and the National Biotechnology Authority has been set up to regulate biotechnology products. Despite an active pipeline of Agri-biotechnology crop innovations seeking regulatory approval, *Bt* cotton remains the only product approved for commercial cultivation and human use since 2019. The industry players have not been able to translate their Agri-biotechnology crop research and development into products in the market. Therefore, this study sought to investigate how strategic entrepreneurship can influence the commercialization of Agri-biotechnology crop innovations in selected organizations in Nairobi City County, Kenya. Specifically, the study examined the effects of entrepreneurial mindset, entrepreneurial culture, strategic entrepreneurial leadership, and strategic resource management on the commercialization of Agri-biotechnology crop innovations in selected organizations in Nairobi City County. The study was founded on four theories: Technology Commercialization Theory, Strategic Entrepreneurship Theory, Knowledge Spillover Theory, and Theory of Traditional Agriculture. The study employed a descriptive survey research design. The target population was 15 organizations involved in Agri-biotechnology research and development in Nairobi City County, as identified from the National Biosafety Authority website. Proportionate stratified and random sampling techniques were used. Data was collected from 46 scientists distributed among the three strata. Semi-structured questionnaires were used to collect primary data from the respondents. Construct validity of the data collection instrument was tested through a pilot study of two organizations from two different strata. Advice was sought from the supervisor on the validity of the questionnaire. The overall Cronbach's alpha was 0.898, hence acceptable. The data was coded, categorized, and then analyzed through descriptive statistics and inferential analysis using SPSS version 30. The results demonstrated that strategic entrepreneurial mindset, entrepreneurial culture, strategic entrepreneurial leadership, and strategic resource management all had a positive and statistically significant effect on the commercialization of Agri-biotechnology crop innovations. The qualitative data identified bureaucracy, funding gaps, knowledge gaps, regulatory barriers, poor public perception, and market access barriers as the significant challenges hindering the practical commercialization of Agri-biotechnology crop innovations. The study concluded that strategic entrepreneurial practices can enhance the commercialization of crop innovations in Nairobi City County, Kenya. The study recommended that organizations include strategic entrepreneurial practices in their strategic plans to enhance the commercialization of their research outputs. It also recommended that private organizations pursue strategic partnerships to strengthen their capacity and that the government allocate additional budgetary resources to support Agri-biotechnology research.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

The agricultural sector remains the backbone of most developing countries' economies as they grapple with poverty (Aragie, McDonald, Ferrari & Dudu, 2016). Over the years, individual governments have invested heavily in the sector, promoting growth in the industry. Most recently, the private sector has increased funding for agricultural research in developed countries. Low- and middle-income countries are not left behind as the private sector's involvement in agricultural innovation systems increases. However, this remains relatively low (Singh, Jha & Kumar, 2014). Africa has the lowest agricultural productivity. It largely practices subsistence farming with low production levels and productivity (Aragie *et al.*, 2016).

Innovation has significantly contributed to the advancements in the agricultural sector (Smyth, Falck-Zepeda & Ludlow, 2016). This has contributed to the rise in the use of technology in agriculture to solve modern-day global challenges such as increasing population, poverty, hunger, and climate change. Climate change has accelerated biodiversity loss, undermining global food security (Otieno, Ogola, Recha & Fadda, 2022). This has prompted research aimed at developing ways of overcoming these challenges. One of the areas that has emerged from this is biotechnology. Biotechnology has evolved significantly since the early 20th Century, beginning with the discovery of antibiotic penicillin and continuing to the present day, where biotechnology innovations played a key role in combating the COVID-19 pandemic.

Biotechnology is a field of technology that utilizes living organisms or their by-products to either make new products or improve existing ones (Kivuva, Yegon & Ndue, 2017). The global biotechnology industry is rapidly expanding. According to Precedence Research (2023), the industry was valued at \$1,224.31 billion in 2022 and was expected to surpass \$3,200 billion within this decade, with an exponential growth rate of 12.8%. There are 4 main sectors of biotechnology: medical biotechnology (which includes biopharmaceuticals), industrial biotechnology (which includes biofuels and bioplastics), environmental biotechnology (which addresses pollution and environmental conservation), and agricultural biotechnology.

The biopharmaceutical industry has the most applications for registration at 41.46%, followed by bio-industries (24.41%) and Agri-biotechnology (20.70%). The industry is dominated by North America (37.76%), followed by Europe (28.77%) and Asia-Pacific (23.80%) (Precedence Research, 2023). Although biotechnology has made significant advancements in the pharmaceutical sector, its most profound impact has arguably been in agriculture. Agri-biotechnology has revitalized hopes for sustainably producing food for the rising global population. There has been an increase in GM crops that are resistant to various environmental stresses (Masehela & Barros, 2023).

Agri-biotechnology has taken several forms in the modern age. Earlier, Agri-biotechnology introduced herbicide and insect resistance properties to 3 major crops, cotton, maize, and soybeans (Barrows, Sexton & Zilberman, 2014). Genetic engineering is one of the most common forms of

Agri-biotechnology. It involves transferring commercially valuable genes from one organism to another. Genome editing involves the alteration of DNA in the genome of an organism.

Synthetic biology is a multidisciplinary area of research that seeks to design and modify genetic materials and living organisms using tools like DNA synthesis, bioinformatics, genome editing, artificial intelligence, machine learning, and RNA interference. Synthetic biology has experienced rapid growth due to its potential to address critical planetary challenges like climate change, food insecurity, and diseases. Current techniques have focused on enhancing the potential of the agricultural sector (CBD, 2022).

Researchers in Germany have collaborated to develop cell-free biosynthesis, which combines artificial intelligence and synthetic biology to create antimicrobial peptides from DNA. This has the potential to address the antimicrobial resistance menace. There has also been a recent development of metal-organic coated bacteria as a potential alternative to chemical fertilizers. The ability to deploy microbes as fertilizers would address the rising greenhouse gas emissions and help reduce the carbon footprint (Trafton, 2023).

Agri-biotechnology continues to grow as new crop and seed varieties are developed (Smyth *et al.*, 2016). Agricultural biotechnology has led to the introduction of improved crops with better traits like drought-resistance, pest and disease-resistance, as well as improved yields. With crops of such traits, the world can increase food security and build resilient and sustainable agricultural practices (Otieno *et al.*, 2022).

The Cartagena Protocol on Biosafety (CPB) is an agreement under the Convention on Biological Diversity (CBD) that regulates and ensures the responsible use of genetically modified organisms (GMOs). It was developed due to the potential risk and negative impact of modern biotechnology applications. It outlines general principles applicable to all living modified organisms (LMOs) as well as specific guidelines on aspects such as transboundary movement and methodology of assessing risks posed by GMOs. The CPB also instituted the Biosafety Clearing House (BCH) to facilitate information exchange and coordination between the national focal points and competent authorities in each member country.

The protocol has set the stage for proper regulation of biotechnology to promote its adoption, innovation, and trade in LMOs (MoEF&CC, 2017). Using the CPB as a reference, several countries have adopted biotechnology. As of November 2023, 173 countries had ratified the protocol (MoEF&CC, 2017). As of 2014, half of the genetically modified (GM) crop-growing countries were from the West (Smyth *et al.*, 2016). The United States (US), Canada, Argentina, Brazil, and India are among the leading countries in Agri-biotechnology (ISAAA, 2019; Smyth *et al.*, 2016).

In Argentina, 99% of soybean varieties have been modified to have the herbicide-tolerance trait. Compared to the more liberal implementation of biosafety regulation in the US, the European Union (EU) has adopted a more conservative approach to the regulation of GM organisms. This has seen a reduction in the number of GM crops within the EU (Ongu, Olayide, Alexandersson,

Mugwanya & Ericksson, 2023). Biotechnology continues to grow rapidly with an increasing number of products developed from enzymes, microbes, and proteins.

The adoption of Agri-biotechnology in Africa was initially slow, with adoptions only in South Africa, Burkina Faso, and Sudan. However, it has picked up with a rapid increase in GM crops and an active pipeline of Agri-biotechnology products. Nigeria, Ethiopia, Malawi, and Kenya have joined the list of countries that have approved the production of insect-resistant GM cotton varieties for commercial use. Ghana, Uganda, and Kenya are already evolving beyond small-scale field experiments to the general release of GM varieties (Komen, Tripathi, Mkoko, Ofosu, Oloka & Wangari, 2020). Africa has taken the lead in the number of countries adopting GM crops. As of 2019, 29 African countries had adopted Agri-biotechnology, representing double the number of countries from 2009 (ISAAA, 2019). This rise in Agri-biotechnology adoption has been associated with increased awareness among experts and the public (AATF, 2021).

Africa has a huge potential to benefit from the positive impact of modern Agri-biotechnology. It faces a myriad of problems in the agricultural sector for which Agri-biotechnology presents a promising solution. Agri-biotechnology can help to improve agricultural production and lead to food and nutrition security while also stimulating growth in the economy (Masehela & Barros, 2023). However, there is a great need to move from research and development to the commercial release of GM agricultural products (AATF, 2021). The adoption of Agri-biotechnology should be carried out in a manner that factors in an individual country's areas of priority in the agricultural sector (Kivuva *et al.*, 2017).

Agricultural biotechnology in Kenya has evolved since the development of biofertilizers in the 1970s. Tissue culture emerged early in the 1980s and became widely adopted in pyrethrum propagation within the decade. Genetic engineering emerged in 1991 following the partnership between Kenya Agricultural Research and Innovations (KARI) and Monsanto Co. Ltd to develop transgenic sweet potatoes resistant to the feathery mottle virus coat protein (Falconi, 1999). Kenya is also one of the countries that have signed and formalized the CPB protocol and established a national authority to oversee its implementation locally.

1.1.1 Commercialization of Agribiotechnology Crop Innovations

Commercialization has been defined as the process of translating ideas into product development using technology to release the products into the market (Gatignon & Xuereb, 1997). This emphasizes the vital role of technology commercialization in product R&D and competitive advantage (Kim, Seok, Choi, Jung & Yu, 2020). Ludmila & Denys (2016) argue that commercialization in scientific research and technology-based industries is best measured using scientific and technology output indicators such as patents and research publications. Commercialization is also a means of leveraging outcomes from an R&D process and making them available for public use (Maurset, 2020).

The concept of commercialization also applies to both academic and government research institutions. In this context, commercialization is seen as the act of growing the institution's profile, influence, and prestige through marketing its research-based projects (Louis, Blumenthal, Gluck & Stoto, 1989). Fini, Rasmussen, Siegel & Wiklund (2018) defined commercialization as

transferring public science innovations to the general public to generate a positive impact on society. In such institutions, commercialization depends on the establishment of an entrepreneurial system through technology transfer offices, the capabilities of the research teams, and the motivation to pursue commercialization (Maurset, 2020).

Several countries have enhanced their agricultural sectors through technological advances. This success is largely attributed to the use of new technology and the ability to commercialize Agri-biotechnology innovations (Anand & Raj, 2019). Beyond developing technology to improve agriculture, an organization must be able to bring the resulting products into the market sustainably and effectively. Commercialization is a key aspect of transforming the agricultural sector. It positively impacts agricultural productivity and the nutritional status of the population (Jiang, Ishdorj, Tabares, Song & Norton, 2023; Minot, Warner, Dejene & Zewdie, 2021). The ability to commercialize Agri-biotechnology innovations in time and efficiently encourages investment in R&D in the sector (Smyth *et al.*, 2016). It enhances the contribution of agriculture toward economic sustainability and can transform the agricultural sector to improve food sufficiency and nutrition (Jiang *et al.*, 2023).

The first GM crop given the green light for commercialization and human use was Calgene's Flavr-Savr tomato in 1994 in the US. However, low- and middle-income countries have struggled to commercialize their Agri-biotechnology innovations. This has been attributed to several factors, including stringent regulatory requirements (Komen *et al.*, 2020; Smyth *et al.*, 2016), low prices for cash crops (Niguse & Mebratu, 2023), and market inaccessibility (Gachuhi, 2021). As a result,

most interventions aimed at agricultural transformation have focused on the commercialization of the products (AATF, 2023; Gachuhi, 2021). Organizations in Africa's agricultural sector are increasingly emphasizing the promotion of the commercialization of Agri-biotechnology innovations (AATF, 2023; MAPCC, 2022).

The tedious regulatory approval process leads to increased costs of developing GM crops. The stringent regulatory requirements also create uncertainty, making innovations risky. The process is also resource-intensive and expensive (Ongu *et al.*, 2023). These negatively impact the willingness of investors to invest in Agri-biotechnology innovations. This renders investment in some innovations unsound, and some of them are abandoned before commercialization. Generally, regulations are technological innovations and adversaries (Komen *et al.*, 2020). Consequently, only multinationals can pursue the approval process to completion and be able to introduce the final products into the market.

The difference in regulatory requirements has also led to disparity between states. For example, Brazil, which has less stringent regulations and hence shorter approval timelines, has attracted more investment in the Agri-biotechnology sector compared to neighboring countries like Canada (Smyth *et al.*, 2016). The low prices of staple food commodities have also discouraged huge investments in technology to improve these foods, as investors are not able to meet their expected return on investment, whose rates may be above 50% (Smyth *et al.*, 2016). This is coupled with sociocultural factors, such as consumer preference, which affect the consumption of GM crops (Niguse & Mebratu, 2023).

Other factors that affect the commercialization of Agri-biotechnology include population, demographic changes, infrastructure, trade policies, and macroeconomic factors (Jiang *et al.*, 2023). Concerns have also emerged about the possible thinning of private investment in Agri-biotechnology research and development owing to poor consumer acceptance and stringent government regulation (Singh *et al.*, 2014). The move to include socio-economic considerations in decision-making during approval of Agri-biotechnology applications is likely to lengthen the process and increase the cost.

South Africa leads in the commercialization of GM crops, with transgenic soybean, maize, and cotton approved for commercialization. Most other Agri-biotechnology countries have fewer approvals for commercial cultivation. The most common crop approved for commercialization in Africa is the *Bacillus thuringensis* (*Bt*) cotton, with Kenya, Malawi, Nigeria, Ethiopia, and Sudan having approved it. The restricted regulation of Agri-biotechnology innovations by the EU has also negatively impacted the commercialization of these innovations in sub-Saharan Africa, since 40% of the region's exports go to the EU market. The duration and costs of the regulatory process hinder the successful commercialization of innovations (Ongu *et al.*, 2023). This study sought to establish the effect of duration and cost of regulatory processes on sustainable commercialization.

Successful product commercialization represents a fundamental objective for all business ventures. As such, Tijani *et al.* (2020) define sustainable commercialization as a firm's ability to secure and perpetuate leadership in the market by improving its market share, growing its sales and revenue, and increasing profitability. This study will employ these financial variables as

measures of sustainable commercialization since commercialization involves generating sales and revenue amidst competition.

According to Yermachenko, Hrebennyk, Litvinov, Klus, and Podmanicka (2023), commercialization is the process of turning technological innovations into products that satisfy the needs of the market. The study highlighted the process followed in scientific research, noting the lack of aspects of commercialization such as a business model, sales, and a scale-up plan. It proposed that firms can commercialize through incubators, licensing, cooperation, spin-offs, research consortia, licensing, patenting, and direct business partnerships. The current study will use licensing, patenting, and collaborations as measures of commercialization. The field of Agri-biotechnology is a highly innovative field that involves intellectual property rights. This makes licensing and patenting key variables that have been used by other authors (Marx, Gans, and Hsu, 2021; Ludmila and Denys, 2016). Also, due to its resource-intensive nature, collaborations and competition are viable variables.

1.1.2 Strategic Entrepreneurship

Strategic entrepreneurship is conceptualized as the synergistic integration of exploiting current competitive advantages while simultaneously exploring novel possibilities to expand those advantages in the future (Hitt, Ireland, Camp & Sexton, 2001; Ireland *et al.*, 2001). This is what (Hitt *et al.*, 2011) defined as the nexus between recognizing new possibilities and seeking to gain a competitive edge. In other words, strategic entrepreneurship explains how firms create and sustain competitive advantage. Simsek, Heavey & Fox (2017) identify three dimensions that

characterize strategy and entrepreneurship: actions taken, cognitive processes underlying the actions, and a specific set of capabilities.

Tijani *et al.* (2020) describe the concept of strategic entrepreneurship as all organizational activities undertaken by a firm to exploit opportunities and sustainably create wealth. The study identifies six measures of strategic entrepreneurship: innovativeness, strategic leadership, strategic flexibility, dynamic capabilities, adaptability, and risk-taking. Yermachenko *et al.* (2023) also employed strategic flexibility, strategic adaptation, and dynamic flexibility to determine strategic entrepreneurship. The current study will measure strategic leadership, strategic flexibility, and risk-taking as they relate to strategic entrepreneurship.

Withers, Ireland, Miller, Harrison & Boss (2018) identified four dimensions in defining strategic entrepreneurship. These are entrepreneurial mindset, entrepreneurial culture, entrepreneurial leadership, and strategic management of resources. These variables were also proposed by Hitt *et al.* (2001). While an entrepreneurial mindset promotes growth, creativity, and flexibility, entrepreneurial culture sets the organization's common values, and strategic leadership leads the organization towards the desired position. The study posits that effective strategic management implementation requires a firm to combine these dimensions in its operations. The current study adopted these variables to measure strategic entrepreneurial behavior.

This study conceptualizes strategic entrepreneurship as an organizational capability comprising systematic processes for opportunity identification, evaluation, and exploitation in the Agri-

biotechnology industry. These actions are not limited to private firms but can also be undertaken by not-for-profit firms like government institutions. The study views these actions as actively looking for and capitalizing on new opportunities to develop innovative products and/or services that can be presented to the market. Such products and/or services will serve as strategic assets contributing to the organization's competitive advantage in the market.

Several developed countries have successfully adopted, implemented, and commercialized modern Agri-biotechnology innovations. One such country is Argentina, which has the 3rd largest Agri-biotechnology crop cover. It has over 2500 field trials with 60 approved events. The exportation of GM crops contributes to over 50% of its export revenue. Argentina is now recognized as a Food and Agriculture Organization (FAO) Reference Centre for GM organism biosafety. This success has been attributed to massive civic education and political goodwill (AATF, 2021).

The wide adoption of *Bt* cotton globally has been associated with positive impacts. Before its approval for commercial cultivation, India was estimated to lose over half of its cotton yield to pests. However, *Bt* cotton transformed cotton growing, leading to a 58% increase in yield. This also saw a reduction in the use of pesticides, reducing the costs by 50%. China reported 85% of benefits directly to the farmers after adopting *Bt* cotton. It was also associated with environmental, economic, and health benefits, which occasioned the reduction of cotton prices in the market (Smyth *et al.*, 2016).

An extensive body of literature has examined both the benefits and potential risks associated with GM crops. The growing experience with these innovations continues to allay the fears over their potential risks. There have been few links between Agri-biotechnology and adverse agricultural or environmental effects. Instead, these innovations have continued to produce higher crop yields with reduced insect damage, thereby reducing the use of chemical insecticides (Komen *et al.*, 2020).

Agri-biotechnology innovations have also led to the enhancement of useful traits, the elimination of undesirable traits, better control of genetic materials than traditional techniques, and reduced prices of farm outputs. It has led to the improvement of crops that had otherwise been neglected by multinational corporations, such as sweet potatoes, cassava, and millet, but which are vital to the poor population (Ozor, 2015). Several institutions and organizations, such as the International Service for the Acquisition of Agri-biotech Applications (ISAAA), the Open Forum on Agricultural Biotechnology (OFAB), and BioAware, have taken an active role in educating the masses and sharing information to improve public perception and acceptance of GM crops.

Agri-biotechnology can broaden the scope of agriculture from merely household consumption to industrial use (Omoro, 2013). To revamp the agricultural sector, Africa can borrow from the successes of other countries. Given the growing body of evidence supporting the benefits of Agri-biotechnology innovations, countries in sub-Saharan Africa continue to develop policies and frameworks to enhance the adoption of Agri-biotechnology (Komen *et al.*, 2020). These policies support innovation in the agriculture sector to improve productivity and tackle emerging

challenges such as hunger and climate change. Growing political goodwill and predictable decision-making have enhanced the adoption and commercialization of these innovations (AATF, 2021).

There has been an increasing acceptance by various stakeholders that traditional agricultural techniques are no longer adequate and sustainable and that modern Agri-biotechnology innovation would play an important part in improving productivity in the sector (Kivuva *et al.*, 2017). The African Agricultural Technology Foundation's strategy for 2023-2027 has prioritized the scaling up and commercialization of agricultural biotechnology innovations. To do this, it seeks to fast-track the approval process of biotechnology products and to grow the markets for the Agri-biotechnology innovations. Projections based on current adoption rates suggest this will contribute to a 20% increase in agricultural yield (AATF, 2023).

Commercialization and strategic entrepreneurship both share two main aspects: innovation and competition. Both concepts emphasize that, to stand out among competitors, a firm must be able to develop new and improved products that address the customers' needs. Strategic entrepreneurship focuses on the process of introducing a novel idea into the market, while commercialization focuses on continuous research and product development. However, both aim to meet customer needs in the competitive organizational environment.

1.1.3 Agri-biotechnology Crop Innovations in Kenya

KARI is the foremost Agri-biotechnology research institution in Kenya. Other institutions involved in this industry include the African Agricultural Technology Foundation (AATF), Kenya Agricultural and Livestock Research Organization (KALRO), International Maize and Wheat Improvement Centre (CIMMYT), Kenya, and Africa Harvest Biotech Foundation. Developers of modern Agri-biotechnology in Kenya include Bayer Crop Science, Mahyco, Pioneer Hi-Bred Kenya Ltd, Donald Danforth Plant Science Center (DDPSC), the University of Nairobi (UoN), Jomo Kenyatta University of Agriculture and Technology (JKUAT), and Masinde Muliro University of Science and Technology (MMUST).

The NBA works closely with other regulatory bodies such as the Kenya Plant Health Inspectorate Service (KEPHIS), Kenya Industrial Property Institute (KIPI), Kenya Bureau of Standards (KEBS), the Pest Control Products Board (PCPB), and the National Environment Management Authority (NEMA) to manage the proper handling, transportation and use of biotechnology innovations. These policy reforms set the stage for the adoption of modern Agri-biotechnology innovations. However, in 2012, the government imposed a ban on the importation and open-field farming of genetically engineered crops. The ban was lifted in 2022 but was quickly followed by a court order blocking the execution of the ban lift following a suit filed by activists (Snyder & Kamau, 2022).

In 2019, the commercial cultivation of insect-resistant *Bt* cotton received a nod from the regulator, making it the first GM crop to be commercially cultivated (Snyder & Kamau, 2022). In 2021, the

NBA approved KALRO's application for the cultivation of transgenic cassava, which is resistant to the cassava brown streak virus disease (NBA, 2021). However, this is yet to be commercialized. Kenya has an active pipeline of crop biotechnology innovations currently under confined field trials, which includes drought-tolerant maize, insect-resistant maize, vitamin A, iron, and zinc biofortified sorghum, Mosaic disease-resistant cassava, virus-resistant sweet potato, and late blight-resistant potato.

Kenya has not been left behind in embracing modern Agri-biotechnology innovations. There are 6 events on gene editing under lab research (NBA, 2023). Kenyan researchers are currently exploring synthetic biology to detect cassava brown streak disease and cholera in humans in a Ksh. 12 million project funded by the government through the National Commission for Science and Technology (NACOSTI) (Snyder & Kamau, 2022).

1.2 Statement of the Problem

The Agri-Biotechnology industry in Kenya has seen minimal commercialization of crop innovations. This is despite agriculture being the dominant sector in the economy, contributing 33% of the gross domestic product (GDP), with the potential to grow further. It ranks as the second-largest private-sector employer in the country (ASTGS, 2019; KNBS, 2023a). With the poverty rate in Kenya standing at 36.15% in 2021, coupled with a rising population and climate change, Kenya has experienced a decline in agricultural productivity (KNBS, 2023b; Otieno *et al.*, 2022). Consequently, Agri-biotechnology innovations remain vital in ensuring food security

(Ahmed *et al.*, 2021; Jiang *et al.*, 2023; Ozor, 2015). However, there is very little commercial output to this effect.

The government of Kenya has implemented multiple policy frameworks to support the growth of the Agri-biotechnology industry. In May 2000, Kenya became a signatory to the Cartagena Protocol on Biosafety (CPB), ratifying it in 2002. The Kenya National Biotechnology Development Policy was developed in 2006 with R&D and commercialization of modern Agri-biotechnology as some of the key focus areas (Kivuva *et al.*, 2017). This was followed by the longer-term Vision 2030 in 2008. This was aimed at transforming the Kenyan economy into an industrializing, middle-income country. It identified agricultural R&D as one of the pillars of economic transformation (GOK, 2007). Kenya then established the National Biosafety Authority (NBA) as the national regulatory authority for biotechnology products and the focal point.

Kenya has put in place an elaborate approval process for genetically modified innovations. There is also an active pipeline of GM crops under various stages of the approval process. Forty (40) GMO varieties have been approved for contained-use research activities (lab and greenhouse research) (NBA, 2023). Despite all these efforts, the only commercially cultivated GM crop in Kenya is the insect-resistant *Bt* cotton, which was given a nod by the regulator in 2019 (Snyder & Kamau, 2022). This represents a paltry 2.5% of the approved in-house research projects. The players in the Agri-biotechnology industry have not been able to translate the active Agri-biotechnology innovations pipeline into marketed products to meet the population's needs.

Previous studies have attempted to explain agricultural commercialization. However, most of these studies have been limited to smallholder agriculture for household consumption. The few studies focusing on agricultural innovations' commercialization have had a narrow scope (Ateka, 2021). Limited studies are looking at the commercialization of modern Agri-biotechnology innovations. The few available studies were conducted outside Kenya (Ahmed *et al.*, 2021; Jiang *et al.*, 2023; Minot *et al.*, 2021) and mostly in developed nations where data from the industry have been tracked for several years. There are also limited studies on the role of strategic entrepreneurship in commercialization. This current study addresses four critical gaps in the existing literature: theoretical deficiencies, contextual limitations, conceptual ambiguities, and empirical knowledge voids. The study fills the missing data specific to the Kenyan context and provides measures of the study variables in the Agri-biotechnology context.

1.3 Research Objectives

1.3.1 General Objective

To investigate the effect of strategic entrepreneurship on the commercialization of Agri-biotechnology crop innovations in selected organizations in Nairobi City County, Kenya.

1.3.2 Specific Objectives

The study had the following specific objectives:

- i. To establish the effect of strategic entrepreneurial mindset on the commercialization of Agri-biotechnology crop innovations in selected organizations in Nairobi City County, Kenya.
- ii. To determine the effect of entrepreneurial culture on the commercialization of Agri-biotechnology crop innovations in selected organizations in Nairobi City County, Kenya.
- iii. To find out the effect of strategic entrepreneurial leadership on the commercialization of Agri-biotechnology crop innovations in selected organizations in Nairobi City County, Kenya.
- iv. To examine the effect of strategic resource management on the commercialization of Agri-biotechnology crop innovations in selected organizations in Nairobi City County, Kenya.

1.4 Research Questions

- i. What is the effect of an entrepreneurial mindset on the commercialization of Agri-biotechnology crop innovations in Nairobi City County, Kenya?
- ii. What is the effect of entrepreneurial culture on the commercialization of Agri-biotechnology crop innovations in Nairobi City County, Kenya?
- iii. What is the effect of entrepreneurial leadership on the commercialization of Agri-biotechnology crop innovations in Nairobi City County, Kenya?

- iv. What is the effect of strategic resource management on the commercialization of Agri-biotechnology crop innovations in Nairobi City County, Kenya?

1.5 Significance of the Study

This study is significant as it addresses a critical intersection between strategic entrepreneurial practices and the commercialization of Agri-biotechnology crop innovations. Agriculture remains the backbone of Kenya's economy, yet it remains unexploited despite the emerging issues such as climate change. With emerging global challenges of drought, food insecurity, and poverty, there is a need to transform the agricultural sector to be resilient and sustainable to improve productivity. By studying the strategic entrepreneurial practices that drive the commercialization of Agri-biotechnology crop innovations, this study contributes to a more sustainable and commercially viable agricultural sector.

First, the study provides empirical insights into how strategic entrepreneurship can enhance the commercialization of Agri-biotechnology crop innovations in Kenya. It offers valuable lessons for crop research scientists, agripreneurs, and investors on enhancing the commercialization of their crop innovations. This will help them identify areas of improvement and overcome systemic barriers in the pursuit of commercially viable crop innovations. The study results will be useful to the players in the Agri-biotechnology industry in improving the transition from research and development to commercializing their innovations. It will guide the players on how to integrate scientific research, technological innovation, and entrepreneurship to meet their strategic goals.

Second, the study will inform the government, policymakers, and regulatory agencies of the necessary policy changes and frameworks to support entrepreneurship in the Agri-biotechnology industry. It will help to align the government's priorities, policies, and strategies towards meeting the local needs and addressing the challenges faced by Agri-biotechnology researchers. The study supports the broader goals of Kenya's Vision 2030 by providing insights on innovation-led agricultural transformation.

Lastly, the study will benefit institutions of higher learning and researchers by contributing to the discipline and improving understanding of the status, obstacles, and prospects for Kenya's Agri-biotechnology innovations. The study contributes to the fields of agricultural entrepreneurship, strategic management in the agriculture sector, and biotechnology commercialization. It will also serve as a reference for subsequent research on the commercialization of Agri-biotechnology research and sustainable agribusiness.

1.6 Scope of the Study

This study was confined to a descriptive survey of strategic entrepreneurship and the commercialization of Agri-biotechnology crop innovations in Nairobi City County, Kenya. It specifically centered on how strategic entrepreneurial practices – strategic entrepreneurial mindset, entrepreneurial culture, strategic entrepreneurial leadership, and strategic resource management – influence the commercialization of Agri-biotechnology crop innovations. The study also identified barriers to commercializing these innovations and proposed solutions to address these challenges.

The geographic scope was limited to Nairobi City County, Kenya. This is because Nairobi is uniquely positioned as the hub for research institutions, academic institutions, agricultural start-ups, and policy-making institutions. Nairobi presents a dynamic context where agriculture, biotechnology, and entrepreneurship intersect. This makes it most suitable for examining strategic entrepreneurial practices and the commercialization of Agribiotechnology research innovations.

This study zeroed in on firms and institutions actively engaged in the commercialization of Agribiotechnology crop innovations in Kenya. These organizations constitute the key stakeholders within the Agri-biotechnology crop innovation ecosystem. The Agri-biotechnology industry in Kenya comprises national research institutes, academic institutions, and private firms, all of which were included in the study. This study concentrated on firms engaged in modern Agri-biotechnology innovation in crops. This excluded traditional methods such as tissue culture, which have already been extensively studied. Crops represent a critical research focus owing to their versatile applications as food, feed, and fodder. In addition, crop farming also forms the largest proportion of agricultural activities in Kenya.

The study was conducted between September 2024 and February 2025, a timeframe that allowed data collection from diverse institutions to comprehensively describe the status of the Agri-biotechnology industry and assess the commercialization of the crop innovations. Specifically, it examined the level of commercialization of these research innovations during this period, providing a comprehensive description of the industry.

1.7 Limitations of the Study

Some challenges were encountered during the study. First, a lecturers' strike in Kenya hampered data collection from the academic institutions as the lecturers involved in Agribiotechnology crop research were unavailable. These lecturers were part of the respondents from academic institutions. The researcher had to wait until December 2024, when the strike ended, to begin data collection. However, the academic institutions entered an examination period that stretched into January 2025, and most academic staff were busy. Hence, the researcher began collecting data in these institutions in February 2025.

The study faced challenges in achieving full participation among the target institutions. Some private commercial organizations withheld consent while regulatory bodies cited misalignment with their agricultural or commercialization mandates. Despite the low response rate from private organizations, the researcher proceeded with data analysis to mitigate against historical and contextual shifts that could occur with prolonged data collection. To mitigate against reduced external validity, early and late responses were compared. This revealed no statistically significant difference.

1.8 Organization of the Study

This research project is structured as follows: Chapter One provides a background of the research, research objectives, and research questions while highlighting the significance, scope, and limitations of the study. Chapter two presents a theoretical and empirical review of the existing

literature, a summary of the empirical literature that identifies knowledge gaps, and concludes with a presentation of the conceptual framework. Chapter three deals with the methodology to be employed in executing the study. Chapter four presents the research findings and a discussion of the results. Chapter five presents a summary, giving a conclusion as well as recommendations.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter presents the theories underpinning this study and the empirical literature on strategic entrepreneurship and commercialization for improved clarification, comparison, and critique. Theories are a set of suppositions and ideas that seek to explain a given phenomenon or variable. The chapter also explores how previous researchers have studied the variables and what they discovered. It then identifies gaps in the existing empirical literature on the variables under study. It also includes a conceptual framework explaining the relationship between strategic entrepreneurship and commercialization as conceptualized by the researcher.

2.2 Theoretical Literature Review

Theories are postulations that explain the relationship between different variables. This study is founded on 4 main theories: Technology Commercialization theory, Strategic Entrepreneurship theory, the Knowledge Spillover theory, and the Theory of Traditional Agriculture.

2.2.1 Technology Commercialization Theory

The Technology Commercialization theory, also known as the Technology Commercialization Strategy (TCS), was developed by Teece (1986). It seeks to explain why firms fail to commercialize their technological innovations successfully. It also highlights the important role played by business strategy in the sustainable commercialization of innovations. The theory assumes that the innovation developed by the firm has an existing market. It proposes that

sustainable commercialization and profitability require firms to focus their resources on developing innovations that they can commercialize more efficiently than existing and potential competitors. According to Teece (1986), innovation and first-mover advantage do not always translate to successful commercialization and profitability. Firms that develop innovative products and improved processes may sometimes fail to commercialize or even sustain the profitability of their innovations. Despite having the best innovations that are most responsive to customers' needs, these firms may still lose out to imitators or competitors. He attributes this to a lack of appropriate business strategies and requisite capabilities.

Teece (1986) developed a framework to determine factors that lead to successful commercialization. He argues that successful commercialization is based on three factors. First, the firm must have appropriate environmental factors outside the firm and market structure that allow it to recoup the R&D costs and make a profit. Such factors may include strong intellectual property rights protection and unique technology. Secondly, the firm must have a dominant design of the innovation. Finally, the firm must be able to utilize specialized and co-specialized complementary assets for the successful commercialization of its innovation. These include assets such as competitive manufacturing, complementary technology, marketing, and after-sales service.

Based on the available factors, he proposed that a firm can choose either an integrating mode, contracting/cooperating modes, or a mixture of the two when pursuing sustainable

commercialization. He notes that this is particularly important for science- and technology-driven firms, which are characterized by rapidly changing technologies.

This theory assumes that commercialization strategies are static and are made at the beginning of the commercialization process. This assumption has been disputed by Marx *et al.* (2014), who argued that a firm may switch from its initial strategy during the lifecycle of the product in the market. They also propose that commercialization strategies can change based on the type of innovative product and the industry in which the innovation has been made. This theory underpins the concept of the commercialization of innovations and highlights the importance of strategy and entrepreneurship for successful and sustainable commercialization.

Jolly (1997) improved on this theory by arguing that commercialization is a dynamic process. He argues that technology-based innovations do not automatically have commercial potential. Efforts have to go into making commercial sense out of them, and these often involve a lot of back and forth; hence, it is not a linear process. He further argues that the time-to-market varies for each technological innovation. He proposes that firms can engage in collaborative research and assign more researchers to the R&D process. He argues that market orientation should be incorporated early on in the R&D process by engaging the responsible teams through collaborative efforts. These inform some of the measures that this study will adopt, including the number of researchers and engagement of other teams in commercialization.

This theory supports the dependent variable, commercialization, in this study. Specifically, it supports the measures of commercialization used by this study. The framework developed by the theory proposed that for a firm to commercialize successfully, it must have strong intellectual property rights protection, employ specialized complementary functions, and have a dominant design. Consequently, this study uses intellectual rights (patents and out-licenses) and interdisciplinary teams as measures of commercialization.

2.2.2 Strategic Entrepreneurship Theory

The theory of Strategic Entrepreneurship is still a relatively new concept. It was developed at the beginning of the 21st century and is attributed to Duane Ireland and Michael Hitt. The theory sought to integrate the areas of entrepreneurship and strategic management, which had until then developed independently. Ireland *et al.* (2001) built on the argument that the primary goal of any organization is wealth creation and that both entrepreneurship and strategic management are actions of top managers with responsibility over the business, hence a similarity between them. The theory argues that while both entrepreneurial and strategic actions are independently instrumental in organizational growth and success, integration of the two has a synergistic effect that enhances their wealth-creation effects. The authors define entrepreneurial actions as steps taken to exploit new opportunities in a fast-changing world, while strategic actions involve choosing and implementing specific strategies. Strategic actions are developed to pursue entrepreneurial opportunities.

Ireland and the others argue that wealth creation involves identifying, growing, and sustaining income streams. They propose that sustainable income can be measured through market value added (MVA) and firm growth through revenues and profits. They conclude that for an organization to be successful, it must build its strategic management process on entrepreneurial actions. For a firm to grow successfully and create wealth, it must first be profitable and then maintain a higher growth rate than its competitors in the industry. The theory proposes that “the focus of entrepreneurship is growth and innovation, while that of strategic management is gaining competitive advantage”. Turning entrepreneurial opportunities into financial gain requires strategic actions (Luke, Kearins & Verreyne, 2010). Therefore, the two have one thing in common: they both aim to increase wealth creation and lead to economic growth.

The theoretical construct of strategic entrepreneurship emerges from six points of convergence between strategic management and entrepreneurship. These are growth, innovation, networks, globalization, corporate learning, senior management, and governance. While entrepreneurial research and development lead to inventions, strategic actions lead to commercialization, thus turning the invention into an innovation. Networks are collaborations between two or more firms to share new products and technologies. Networking is both an entrepreneurial and a strategic action, and it can occur in the form of mutually-beneficial relationships, licensing, joint R&D, or joint marketing. Networks also enhance internationalization through exports, acquisitions, strategic alliances, licensing, and foreign direct investments.

Hitt *et al.* (2001) later attribute the emergence of this concept to the digital era associated with the emergence of new technologies and increased globalization. They argue that modern-day change causes high levels of uncertainty and that with uncertainty come opportunities. Firms must be ready to spot and take advantage of these opportunities. Therefore, strategic entrepreneurship helps organizations to adapt to the dynamic industry environments and exploit these emerging opportunities. According to Hitt *et al.* (2011), strategic entrepreneurship involves exploiting current competitive advantages while also seeking new opportunities to sustain the competitive advantage or create new ones.

This theory integrates two concepts that are vital to firms in the Agri-biotechnology industry. This study seeks to explore the domains of strategic entrepreneurship, such as innovation, networks, internationalization, and growth, by understanding the opportunities available and the challenges faced in the commercialization of innovations. The theory informed the investigation of the impact of strategic entrepreneurial opportunities on commercialization in the study. As such, this study uses the thematic areas of similarity as measures of the variable strategic management, including creativity and innovation, networks, organizational learning, and top management teams.

2.2.3 Knowledge Spillover Theory

The Knowledge Spillover theory can be traced to the scholarly works of American economist David B. Audretsch. The concept was first mentioned in his work (Audretsch, 1995). However, the theory was fully developed in 2009 in collaboration with other authors. It sought to improve

the endogenous growth model, a theory that proposes that economic growth is the direct result of internal processes.

According to Acs, Carlsson, Audretsch & Braunerhjelm (2009), knowledge is a factor of production input into the research and development process to generate new technology opportunities. Consequently, a firm invests in new knowledge to grow economically. New knowledge in one firm can also inform opportunities for other firms. This is what Audretsch and co-authors call knowledge spillover. The primary firm where the new knowledge is first developed is termed the incumbent. These firms utilize the flow of knowledge to improve existing products. However, new start-up firms may make use of knowledge spillovers to cause radical innovations that create new products or industries. Therefore, startups are better placed to advance innovation in industries and even create new industries, as has been witnessed in the biotechnology and the information, communication, and technology (ICT) industry. The theory, therefore, assumes that new startup firms are responsible for radical innovations.

While Audretsch and co concur with contemporary theories of entrepreneurship that entrepreneurship is about recognizing and deciding to exploit opportunities, they add a new concept to this definition. The scholars advance the idea that entrepreneurship encompasses both the creation and marketing of new products and the exploitation of prospects identified by the incumbent firms that they have not commercialized. Theoretically speaking, entrepreneurship involves exploiting such opportunities, too. The knowledge spillover theory argues that endogenous growth models are based on simplistic assumptions and ignore the key element of

knowledge transmission in entrepreneurship through spillovers. The authors argue that knowledge spillovers can occur when employees leave the incumbent to establish startups. Start-ups exploit their networks to access knowledge from incumbents. The firms depend on the knowledge and experience of their founders and staff gained from incumbents. This proposition changes the unit of analysis of entrepreneurship from the exogenous firm to individual agents within the firm privy to such knowledge.

The theory argues that new knowledge creates new entrepreneurial opportunities. However, these opportunities must be converted into 'economic knowledge' for commercialization. Failure to do this creates spillovers that startup firms can exploit and develop radical innovations. As a result, the scholars argue that entrepreneurship becomes a link through which knowledge spills over from incumbents, leading to the formation of new startups to exploit the knowledge.

Public institutions dominate the Agri-biotechnology industry in Kenya. Knowledge spillovers from these institutions drive Agri-biotechnology startup formation. These startups may commercialize innovations that the public institutions abandon midway. They may also utilize such innovations to develop completely new products. This study sought to explore such entrepreneurial strategies and the commercialization of Agri-biotechnology innovations. This study adopted knowledge management as a measure of the strategic resource management variable. It embraced some of the concepts of this theory to measure knowledge management, including the qualification of research personnel.

2.2.4 Transformation of Traditional Agriculture Theory

The theory of Transformation of Traditional Agriculture was developed in 1964 by Prof. Theodore W. Schultz, an American agricultural economist. The theory classifies agricultural practices into 3 categories: traditional, modern, and transitional. It then focuses on how traditional agriculture in developing countries can transition into modern agriculture to become more productive.

Schultz (1964) sought to clarify misconceptions about what traditional agriculture is. He argued that traditional agriculture has nothing to do with either the traditions of a society or the arrangement of institutions in a country. Traditional agriculture can exist in any country, whether developed or developing, and can exist in both large- and small-scale farming. Instead, he proposes an economic feature of traditional agriculture that can exist in any country at any given time, including in the years to come. He then defines traditional agriculture as a state of economic equilibrium reached when technology in agriculture remains the same for long, people fully comprehend the inputs under the technology, and the cost of the inputs remains the same. In other words, agricultural technology becomes constant. Traditional agriculture is not necessarily ancient, labor-intensive practices, as even advanced agricultural technologies can become traditional with time.

Schultz hypothesized two characteristics of traditional agriculture: allocative efficiency ('poor but efficient' hypothesis) and the doctrine of zero-value labor. He also argued that all factors of production are unemployed, hence there is no disguised unemployment. However, these have come under criticism by various scholars (Dandelar, 1966; Schultz, 1966). One of the arguments

was that decisions on the allocation of resources are complex and influenced by many factors, leading to imperfect allocation.

Schultz also challenged the development economists' view that farmers in emergent nations act irrationally and are unwilling to embrace innovation. He argues that this is rational thinking, as these farmers are reacting to poor government policies on agriculture, such as high taxation and low market prices of food crops.

Schultz (1964) explains how developing countries can increase agricultural productivity and maximize returns. First, he proposes that developing countries can change the nature of factors of production by introducing new factors of production. This can be done through two approaches: the market approach, which grants farmers the freedom to adopt, or the command approach, where the government supplies and directs farmers to adopt the new factors of production. Schultz argued that the market approach would lead to widespread adoption, while the command approach ignores the actual issues faced by local farmers. He further proposes that the transformation process should target both the supply and demand of factors of production. On increasing demand for new factors of production, Schultz argues that farmers are motivated by profitability. To enhance adoption, he proposes that governments should subsidize the prices of new inputs at the initial stages. This begs the question: Is it practical in modern biotechnology, which is highly costly?

Schultz proposes three steps to improve the supply of new inputs: R&D of new inputs, distribution, and extension of new knowledge. On R&D, he proposes that governments should take the lead

since private firms will be discouraged by the high costs, long time for results to appear, and risk of failure. He also argues that at the initial stages, distribution should be done by the government since private firms are discouraged by the costs, i.e., the cost of adoption, the cost of providing information to users, the cost of opposition from vested interests, and the cost of new skills extension.

This theory posits that science- and technology-driven agricultural transformation serves to improve the agricultural sector in developing countries. It recognizes investment in knowledge as a form of capital. It also emphasizes how incentives, infrastructure, and institutions collectively enable the transformation of the agricultural sector. All these are central to this study, as the study tested some of the propositions made by Schultz, such as incentives, government involvement in agricultural R&D, and technology adoption approaches. This study also investigated the motivation and mindset of scientists involved in Agri-biotechnology R&D.

2.3 Empirical Literature Review

This study adopted four dimensions of strategic management based on the specific objectives. These variables are reviewed in detail below.

2.3.1 Strategic Entrepreneurial Mindset and Commercialization

Gupta, Kim and Strimel (2018) investigated how an entrepreneurial mindset affects fundamental research funding based on their value proposition. This was undertaken through a bimodal

transformation that involved comparing basic and agile research, where technology commercialization is part of the research. The research involved institutions of higher learning in the United States. A search was conducted on the web to determine the research funds received by each university. Commercialization outcomes were measured through two key indicators: the volume of patent applications and the number of start-up ventures established. However, funding is not an end goal but rather part of the R&D exploitation process, hence, it may not be the best outcome measure. This study considered institutions with an entrepreneurial mindset while seeking funding to pursue commercialization. The study was also limited to universities only.

Hayter, Fischer, and Rasmussen (2022) investigated how scientists develop an entrepreneurial identity to become entrepreneurs. They advanced the concept of liminal identity to explain how academic scientists can embrace entrepreneurship and commercialize their technological innovations. The study identified several factors that promote liminality, including motivation, experience, and support from social circles. It identifies intrinsic and extrinsic motivations that impact the ability to develop an entrepreneurial identity. The study was conducted at the individual level and hence may not necessarily explain the impact of mindset at an organizational level. While the study developed the explanatory process model, this current study tested the impact of factors in the model on commercialization. This current study used motivation as a measure of an entrepreneurial mindset.

NawzadSabir, Othman, Al-kake, and Rashid (2019) conducted a descriptive study to investigate the effect of various entrepreneurship mindset on the attitudes toward knowledge commercialization among academic researchers. Two hundred and thirty faculty members of the

University of Technology Malaysia were randomly sampled, and data was collected through a cross-sectional survey. While the study employed measures such as the need for achievement, commitment, and dedication to measure researchers' attitudes, this current study went further to investigate whether this attitude translates into actual commercialization. This study also viewed both attitudes towards commercialization and commitment and dedication as measures of the variable strategic entrepreneurship mindset.

Roundy *et al.* (2018) examined the influence of entrepreneurial awareness on the direction and performance of organizations in North Arlington, Texas, in the United States. Data collection was undertaken through in-person interviews with six hundred eighty-eight firms. Entrepreneurial alertness is conceptualized as the cognitive capability to sense entrepreneurial opportunities, threats, and uncertainties. This is what has been conceptualized in this study as opportunity recognition. The study had a challenge in measuring firm performance due to the reluctance of respondents, and it relied on self-reported measures, which are unreliable. The current study investigated commercialization using quantifiable measures not associated with confidential information.

Jemal (2021) analyzed how entrepreneurial mindset and capabilities influence firm performance through a systematic literature review. The entrepreneurial mindset was measured using innovativeness, creativity, opportunity recognition, proactiveness, and alertness, while commitment was one of the measures for entrepreneurial competence. While the study viewed these two as different but related factors, this current study takes the view that their measures are similar, hence, it will measure them as one variable. The study reviewed forty-eight journals, only

seven of which were peer-reviewed journals. This presents a methodological gap, as the data may be of poor quality. This current study collected primary data, which is known to be more accurate and reliable for generalizing study findings.

2.3.2 Entrepreneurial Culture and Commercialization

Tijani *et al.* (2020) investigated the role of strategic entrepreneurship in the sustainable operations of textile manufacturing enterprises in Lagos state, Nigeria, through a cross-sectional survey. First-hand data was collected using structured questionnaires from two hundred thirty-seven (237) senior staff. Strategic management was measured through innovation, strategic leadership, adaptability, strategic flexibility, and risk-taking. The current study also measured strategic entrepreneurship, but against a different dependent variable. The study presents a conceptual gap in the measurement of strategic management, as this current study takes the view that risk-taking and innovation are individual measures that represent the variable entrepreneurial culture.

NawzadSabir *et al.* (2019) studied the effect of entrepreneurship culture on the attitudes of academic researchers toward knowledge commercialization. In the descriptive study, 230 faculty members of the University of Technology Malaysia were randomly sampled, and data was collected through a cross-sectional survey. Various measures of entrepreneurs' traits were used, including leadership, the need for achievement, risk-taking, and commitment. These were shown to have a statistically significant positive effect on one's attitude towards commercialization. While this study employed similar variables, it departed from (NawzadSabir *et al.*, 2019) in

grouping these measures under different variables. Risk-taking and attitude toward commercialization are treated as two measures under two different variables.

Yermachenko *et al.* (2023) conducted a study examining the commercialization of scientific research in universities in Ukraine and Slovakia. It aimed to understand the attitude of scientists towards entrepreneurship and to identify the steps and strategies used in implementation. The study employed a meta-synthesis of past scholarly works. The study identifies various factors that can be used to measure commercialization, including direct industry partnerships, patents, out-licensing, and creating spin-offs. It also highlights entrepreneurial strategies to promote commercialization, which are relevant to this study. Within this study's theoretical framework, internal policies, procedures, and entrepreneurial intention were operationalized as constitutive dimensions of entrepreneurial culture.

In Cubero *et al.* (2021), a study of the commercialization of disruptive innovations was undertaken through a systematic literature review. Sixty-four pieces of literature from peer-reviewed journals were sampled and analyzed through content analysis to identify the factors affecting commercialization and the process adopted for commercialization. Market orientation and stakeholder involvement emerged among the key constructs affecting commercialization. This current study also adopted the use of these measures of commercialization. However, the study gathered firsthand data directly from the scientists instead of relying on secondary data, as this allowed for relationship testing. This study also focused on a specific sector to enhance the applicability of its findings.

Fini *et al.* (2018) proposed a shift in the measurement of commercialization from entrepreneurial outcomes to the social impact of the innovations. They argue that the purpose of innovations is to impact the final consumers and that R&D processes and marketing of the innovations target these consumers' needs. They also propose the use of longitudinal and multi-level research designs in investigating the social impact of scientific innovations. While this study agrees with the assessment of different stakeholders, it took a different view on how to measure commercialization. The field of modern Agri-biotechnology crop innovations is still relatively new, with few local studies on the R&D. With the limited number of products approved for commercial cultivation (NBA, 2023), it was not plausible to assess social impacts at this point.

2.3.3 Strategic Entrepreneurial Leadership and Commercialization

Maurset (2020) investigated the role played by role models in commercialization through a single case study in the technology research sector. Semi-structured interviews were conducted among six academic researchers with a history of commercialization to understand their personal experiences with role models. Commercialization was measured through patenting, licensing, and university spin-offs. The data analysis also involved identifying keywords on commercialization, such as entrepreneurial education, motivation, intentions, and self-efficacy. Being a case study, the study only considered a few scientists and was limited to the university setting. It was also limited to an individual level of analysis. This study explored institutional factors in addition to individual factors.

Johnson *et al.* (2022) investigated science commercialization by individual agents in universities across the US, the UK, and Russia through the university-centered entrepreneurial ecosystem. Forty-seven respondents engaged in the commercialization of regenerative medicine were purposively selected for a narrative interview. Commercialization support mechanisms, such as training programs, were found to be key. The study was conducted in countries considered to be developed, hence having well-developed entrepreneurial ecosystems. This current study sought to explore the existence of such ecosystems and assess their impact on commercialization in a developing country. This study also considered a different type of biotechnology innovation. The study recommends exploration of other scientific fields, a challenge that this study took on.

Kim *et al.* (2020) studied how technology commercialization and sustainability initiatives collectively influence firm performance. It involved a survey of 409 international firms, with the unit of observation being team leaders and executives within the R&D department. Knowledge management was estimated through learning activities and inter-departmental collaboration, while commercialization was measured through new or improved products. Using knowledge management alone is limited and cannot exhaustively describe the concept of strategic management. It was also the view of this study that knowledge management alone cannot fully represent management capabilities.

Gachuhi (2021) investigated the intensity of the commercialization of soybeans and its determinants among smallholder farmers in Butere, Kenya. An exploratory research design was utilized. A sample size of 201 farmers was selected through multiple stages and then interviewed face-to-face using a semi-structured questionnaire. Some of the variables studied included age,

gender, experience in farming, income level, and education level. However, this study is limited to small-scale agriculture consumption. The present research engaged researchers actively involved in R&D activities. Nairobi City County provided a better study location since it houses most academic and research institutes.

Ndeisieh (2018) studied the strategies for the sustainability of small businesses in Cameroon through an exploratory multiple case study design. Five small food enterprises were purposefully sampled for face-to-face, semi-structured interviews. The factors explored include education, previous experience, leadership experience, access to external support, and entrepreneurship training. The study explored a wide range of strategies, some of which are not relevant to the field of strategic entrepreneurship. The population studied is also not innovation-intensive. The study also presents a methodological gap since case studies are limited to very few firms. This current study employed a different methodology to collect data from different players. This study also assessed commercialization instead of sustainability.

2.3.4 Strategic Resource Management and Commercialization

Falconi (1999) surveyed Agricultural biotechnology research indicators in Kenya by investigating how various resources are used. The study was conducted at one agricultural research institute, selected university departments involved in Agri-biotechnology research activities, as well as two crop research foundations. Among the variables measured were the number of personnel, research expenditure, source of funding, level of donor assistance, research focus areas, and purpose of

donor funding. While Falconi (1999) investigated variables relevant to this study, the present study introduced a new focus on commercialization and intended to investigate how these variables relate to commercialization. The current study also had a broader scope by expanding the number of respondents.

In a preliminary study exploring emerging opportunities and resources for research in Agri-biotechnology research and commercialization, Nyende *et al.* (2013) surveyed 23 scientists drawn from selected universities and public research organizations in Kenya. The scientists were asked to describe their experience and observations on Agri-biotechnology research. Content analysis was then employed to determine challenges affecting the commercialization of Agri-biotechnology research. These factors were then categorized into five resource categories. Exploring personal experiences introduces the risk of bias due to subjective data. This study relied on a semi-structured data collection tool to ensure objectivity in the data collected. In addition, the research tested the effect of some of these resources on commercialization outcomes.

Loganathan *et al.* (2022) investigated the commercialization of agricultural biotechnology to entrepreneurial ventures through a case study of the Indian Institute of Horticultural Research (IIHR). Four startup founders, principal scientists, and the incubator managers were sampled purposively before undergoing in-depth interviews through face-to-face or telephone conversations. The study investigated entrepreneurship development programs as part of the variables for measuring networking. The study was limited to just one entrepreneurial opportunity, networking activities. The current study expanded on this by investigating other strategic

entrepreneurial activities. It also sought to understand networking in agricultural research from a local point of view.

In a study examining the determinants of agricultural technology innovation commercialization in universities across Kenya, Ateka (2021) randomly sampled seventy-seven researchers from JKUAT's College of Agriculture. Data were collected using semi-structured questionnaires. The study considered commercialization training as one of the independent variables, while spin-offs, university-industry collaboration, and commercialization strategy were used to measure the dependent variable. The study was, however, limited to just one institution. This current study expanded on this scope to include different academic institutions and other research institutions dealing with agricultural innovations.

In summary, limited studies are focusing on agricultural innovations in Kenya. The available studies have explored different factors that affect commercialization. However, these factors are general. This study grouped these factors into strategic entrepreneurship to better conceptualize the factors. The studies also focus mainly on institutions of higher learning; hence, these results may not be directly transferable to other firms dealing with agricultural innovations. This study incorporated other firms, including the private sector and public research institutes. This ensured a comprehensive representation of players in the Agri-biotechnology industry in the study.

2.4 Summary of Empirical Literature and Research Gaps

From the empirical literature examined, studies covering all four dimensions of strategic entrepreneurship are limited. Most studies focused on just one dimension to represent the concept, which may not be reliable in fully understanding the effect of strategic management. This study sought to measure all four dimensions of the concept to identify a meaningful connection with the dependent variable.

Limited studies are available on the contribution of strategic entrepreneurship to commercialization. Most of the available studies considered organizational performance as the dependent variable. Organizational performance is measured using different variables that do not apply to commercialization. While organizational performance may apply to any kind of firm, the concept of commercialization is better suited for outputs of R&D and innovation. This leaves a gap in understanding how strategic entrepreneurial practices can influence commercialization. Therefore, the current study aimed to bridge this gap in existing literature.

Most available studies have had a limited focus on just academic research when describing commercialization. However, the field of research in the agricultural sector is largely dominated by public research institutes. There is also private sector involvement in agricultural R&D. This study filled this gap by involving all these industry players in the study to better describe innovations in the sector.

There are no available studies on the commercialization of modern Agri-biotechnology innovations in Kenya. Most studies focus on either agricultural practice at the farm level or traditional Agri-biotechnology practices such as tissue culture. Modern Agri-biotechnology is a complex and resource-intensive undertaking; hence, the commercialization of its outputs is different from other agricultural practices. Consequently, the present research sought to fill this void in the scholarly discourse by focusing on the commercialization of Agri-biotechnology innovations.

Table 2.1 Summary of Literature Review and Research Gaps

| Author (Year) | Focus | Research Findings | Research Gap | How the study filled the existing research gap |
|---------------------------------|---|---|---|--|
| Loganathan <i>et al.</i> (2020) | Commercialization of Agricultural technology to startups through networking | Technology commercialization has led to the emergence of Agritech startups | As a qualitative study, the results are not intended to be generalizable. | This study was quantitative to ensure the results could be generalized. |
| Gupta <i>et al.</i> (2018) | Entrepreneurial mindset vs research funding | Lack of focus on commercialization leads to the death of firms | Scope limited to academic institutions; Funding is not an outcome of R&D | Included public research institutes and private firms involved in Agri-biotechnology research. |
| Hayter <i>et al.</i> , (2022) | Developing an entrepreneurial mindset | Developed a conceptual framework on how an entrepreneurial mindset develops | Measures of entrepreneurial mindset are limited to individual factors. | Explored both individual and institutional factors. Tested the practicality of this framework |
| Ateka, (2021) | Commercialization of innovations in agriculture among | A high cost of research and lengthy approval process are major | The case study is limited to only one | Carried out in universities, public agricultural |

| | | | | |
|----------------------------------|--|---|--|---|
| | Kenyan universities | challenges to commercialization | academic institution. | research institutes, and private firms. |
| NawzadSabir <i>et al.</i> (2019) | Entrepreneurial characteristics vs attitude towards commercialization | Commercialization attitudes improved significantly and positively. | Limited to academic institutions. Also measured only two aspects of an entrepreneurial mindset | Included research scientists from private and public research institutes. Went further to study whether a change in attitude affects actual commercialization |
| Roundy <i>et al.</i> (2018) | Entrepreneurial alertness vs organizational performance | Positive effect of alertness on strategic decisions | Reliance on secondary data. Self-reported measures of performance | Collected primary data from respondents. Used quantifiable measures of commercialization |
| Jemal (2021) | Entrepreneurial mindset vs performance | An entrepreneurial mindset positively affects SME performance | The study primarily used secondary data from non-peer-reviewed publications. | Relied on primary data for reliability and generalizability of the results. |
| Tijani <i>et al.</i> (2020) | The moderating role of the level of education on strategic entrepreneurship and sustainability | Educational attainment significantly enhanced strategic entrepreneurship and technology commercialization | Only one element of strategic entrepreneurship was studied | The study investigated all dimensions of strategic entrepreneurship |
| Maurset (2020) | Influence of entrepreneurial role models on commercialization | Exposure to entrepreneurial role models enhances commercialization | Limited to academic institutions and individual levels of analysis | The study explored other fields involved in agricultural R&D |
| Johnson <i>et al.</i> (2022) | Science commercialization within university entrepreneurial ecosystems | Scientists were observed to take a scientist-entrepreneur | The research was undertaken in developed nations with developed | This study localized the concept of science commercialization |

| | | | | |
|--------------------------|---|---|-------------------------------------|---|
| | | identity to enhance commercialization | entrepreneurial ecosystems. | |
| Kim <i>et al.</i> (2020) | Sustainable management practices and technology commercialization | Sustainable management practices influence technology commercialization | Resource management was not studied | The study incorporated measurement of strategic resource management and evaluated its effect on commercialization |

Source: Researcher (2025)

2.5 Conceptual Framework

The conceptual framework presented in Figure 2.1 below illustrates the conceptual relationship between the independent variable, strategic management, and the dependent variable, commercialization.

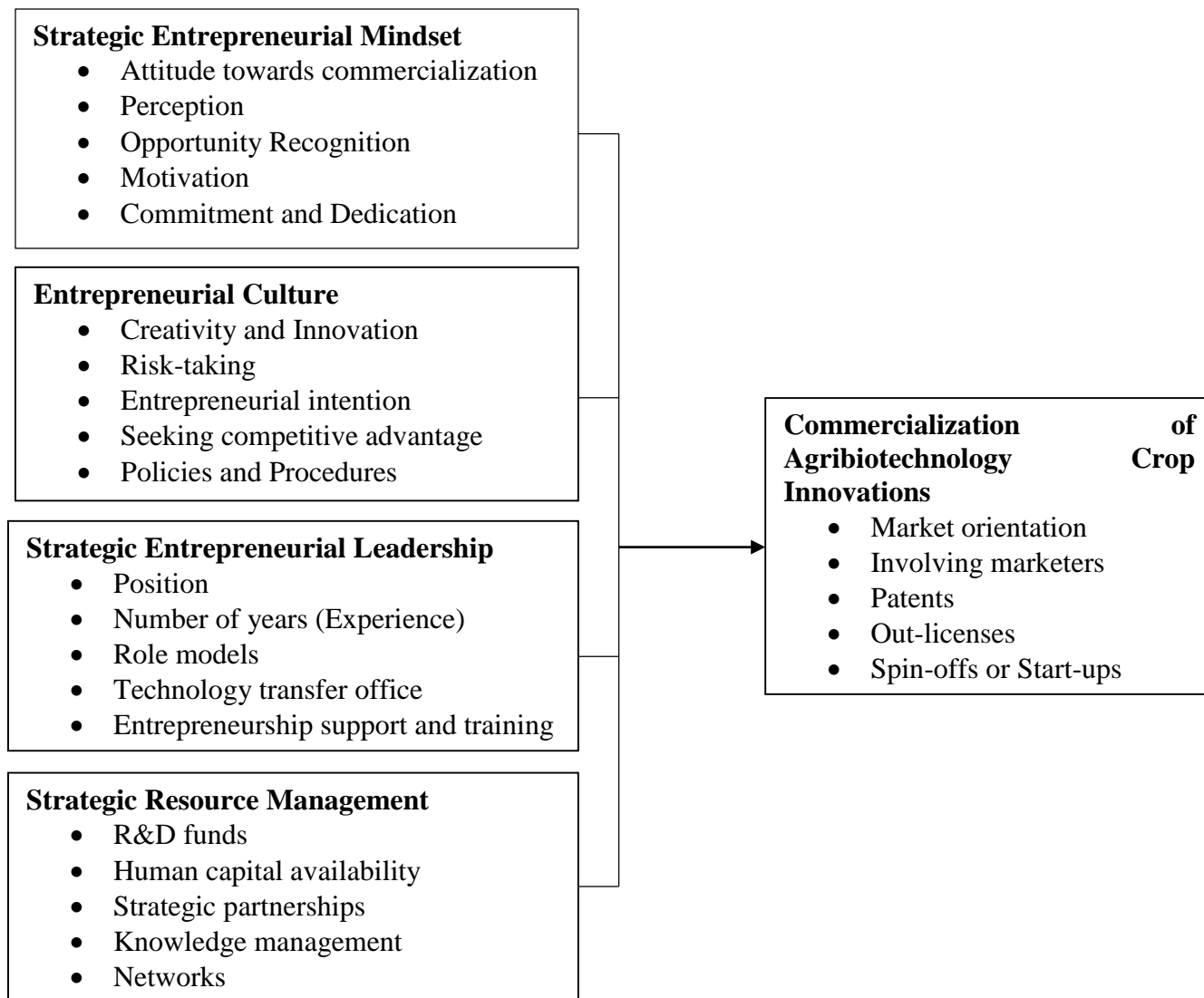


Figure 2.1 Conceptual Framework

Source: Researcher (2025)

The independent variable, strategic management, was measured through four variables: entrepreneurial culture, strategic entrepreneurial mindset, strategic entrepreneurial leadership, and strategic resource management. The dependent variable, commercialization, was measured using five variables adopted from the literature review: market orientation, interdisciplinary teams, patents, out-licenses, and spin-offs or start-ups.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the research methodology used in this study. It includes the research design, target population, sampling design and procedure, data collection instruments and procedure, data analysis and presentation, and ethical considerations of the study.

3.2 Research Design

This study adopted a descriptive survey research design. Descriptive research design is used to exhaustively collect accurate information on the characteristics of a particular event and describe relationships with other phenomena under study (Kothari, 2004; Muathe, 2010; Mugenda & Mugenda, 2019). Ndegwa (2022) noted that this research design is useful in acquiring knowledge on the current status of an event under study. Muathe (2010) and Musau (2018) also noted that descriptive research design helps avoid bias as the variables cannot be manipulated by the researcher. Since this study sought to accurately detail the commercialization of Agri-biotechnology innovations and test the association between strategic entrepreneurship and commercialization, a descriptive research design was deemed appropriate.

3.3 Target Population

The target population included organizations involved in Agri-biotechnology crop research and innovations. These organizations were academic institutions, public agricultural research

institutions, and private sector firms engaged in R&D in modern Agri-biotechnology. This study adopted, with updates, the NBA’s Roster of Experts (NBA, 2024) as the sampling frame. A sampling frame must be complete and free from omissions to minimize errors (Arnab, 2017; Krishnaswami et al., 2010). Consequently, this sampling frame was updated to include other organizations undertaking Agri-biotechnology crop innovations in Nairobi City County absent from the NBA roster of experts.

According to the roster, twelve (12) organizations in Nairobi City County were involved in Agri-biotechnology crop research and development, each employing a different number of scientists. However, three (3) other organizations were identified from previous literature and were added to this investigation. This brought the target population to fifteen (15) organizations as shown in Table 3.1 below.

Table 3.1 Distribution of the Target Population

| Type of Organization | No. of Organizations | % of Total |
|-----------------------------|-----------------------------|-------------------|
| Academic Institution | 3 | 20% |
| Public Research Institute | 5 | 33.33% |
| Private Organization | 7 | 46.67% |
| Total | 15 | 100% |

Source: Adapted NBA (2024)

3.4 Sampling Design

This section illustrates how the units of observation for the study will be selected (Mugenda & Mugenda, 2019). The study adopted a proportionate stratified and random sampling technique. From Table 3.1, the study population was divided into three strata: academic institutions, public research institutes, and private organizations. The sampling approach maintained proportional representation across all strata in the target population. Krishnaswami and Satyaprasad (2010) consider this technique statistically more efficient and reliable than simple random sampling. Additionally, it enabled the examination of individual strata within the heterogeneous population, promoting greater representativeness (Krishnaswami et. al., 2010; Sachdeva, 2008).

There was a total of eighty-eight (88) scientists within the target population who were involved in Agri-biotechnology crop innovation R&D. These included forty-four (44) in academic institutions, twenty-five (25) in public research institutes, and nineteen (19) in private organizations. This study used the (Yamane, 1973) formula to determine the sample size at a 95% confidence level.

$$n = \frac{N}{1 + N(e)^2}$$

Where n = sample size

N = Population size

e = Level of precision

Applying this formula, the sample size was determined to be 72.

$$n = \frac{88}{1 + 88(0.05)^2}$$

$$n = 72$$

Table 3.2: Distribution of Sample Size

| Type of Organization | No. of Organizations | No. of Scientists | Factor | Sample Size | % of Sample Size |
|---------------------------|----------------------|-------------------|--------|-------------|------------------|
| Academic Institution | 3 | 44 | 0.818 | 36 | 50% |
| Public Research Institute | 5 | 25 | 0.818 | 20 | 27.8% |
| Private Organization | 7 | 19 | 0.818 | 16 | 22.2% |
| Total | 15 | 88 | 0.818 | 72 | 100% |

Source: Researcher (2025)

The determined sample size of 72 scientists was considered statistically adequate for the study as it meets the 30% threshold for representative sampling recommended by Mugenda & Mugenda (2019), as cited in Waithira (2020), ensuring generalizability to the target population. Similar studies involving scientists in the Agri-biotechnology industry in Kenya have used even smaller sample sizes (Nyende *et al.*, 2013). The sample size was distributed proportionately in each stratum and each organization based on its size in the total population, as shown in Table 3.2.

3.5 Data Collection Instrument

The study used semi-structured questionnaires distributed using the drop-off/pick-up method to collect first-hand data directly from the study participants. The questionnaire was preferred since it is effective, saves time in data collection, and is free from interviewer bias (Kiprono, 2021). Semi-structured questionnaires are suitable for collecting data from experts as they ensure the collection of rich data while maintaining the objectivity of the data. Semi-structured questionnaires enabled the researcher to collect both qualitative and quantitative data, allowing the researcher to collect rich data reflecting scientists' viewpoints (Mugenda & Mugenda, 2019). The drop-and-pick method enabled respondents to complete the data collection tool conveniently, resulting in favorable response rates (Wanjohi, 2023).

The questionnaires consisted of five sections. Section one covered the demographic profile of the study participants. Section two sought to describe the status of the commercialization of Agri-biotechnology crop innovations in Nairobi City County, Kenya. Sections three, four, five, and six covered the independent variables. A 5-point Likert scale was implemented for matrix questions to measure certain variables and a comprehensive list of possible responses to collect data. Qualitative information on the respondents' opinions on certain variables was collected using open-ended questions.

3.6 Data Collection Instrument

This section presents the pilot testing, reliability, and validity of the data collection instrument, which was a questionnaire.

3.6.1 Pilot Testing of Research Instrument

The questionnaire was pilot-tested against established criteria. The pilot testing was done in 2 firms (10% of the firms/institutions identified). Zientek *et al.* (2016) consider this adequate for pretesting a data collection instrument. The pilot study was administered to 7 respondents (10% of the calculated sample size). The pilot data was analyzed using SPSS version 30 to yield insights that were used to improve the questionnaire. The piloted firms did not constitute part of the unit of analysis.

3.6.2 Instrument Reliability

Reliability is the ability to consistently get similar results from a given research instrument repeatedly under the same circumstances (Habib et al., 2014; Mugenda & Mugenda, 2019). Since the data collection instrument uses several Likert-scale questions, internal consistency reliability was assessed by calculating Cronbach's alpha coefficient. It measures how related a set of questions are. It is a function of the number of measures and the average intercorrelation among them. This helps to ascertain that the questions all measure the same variable. A high Cronbach's alpha confirms the consistency in the response values for the respondents. Different researchers consider a minimum Cronbach's alpha value of 0.7 satisfactory (Kiprono, 2021; Ndegwa, 2022; Oduor, 2022).

Table 3.3 Reliability Test Results

| Variable | Items | Cronbach Alpha | Comment |
|--------------------------------------|--------------|-----------------------|-----------------|
| Strategic Entrepreneurial Mindset | 7 | .652 | Accepted |
| Entrepreneurial Culture | 9 | .823 | Accepted |
| Strategic Entrepreneurial Leadership | 5 | .693 | Accepted |
| Strategic Resource Management | 8 | .709 | Accepted |
| Commercialization | 4 | .762 | Accepted |
| Overall Score | 33 | .898 | Accepted |

Source: Pilot Test Data (2025)

The questionnaire demonstrated high internal consistency, with its 33 items yielding a Cronbach's alpha value of 0.898. This indicates a high reliability in measuring commercialization processes and strategic entrepreneurial practices within the Agri-biotechnology crop innovations domain. However, strategic entrepreneurial mindset and strategic entrepreneurial leadership yielded moderate reliability (0.652 and 0.693, respectively). According to Cooper and Schindler (2014), a Cronbach's Alpha of ≤ 0.6 may be acceptable for exploratory research, a highly specialized population, and highly diverse constructs. This was the case with the measurement of these variables; hence, the reliability scores were accepted. Taber (2018) also noted that a high diversity of constructs being measured under specific variables may have contributed to a low Cronbach's Alpha score. A similar approach was adopted by other scholars such as Muathe (2010). Given the high overall reliability score, the data collection tool aligns with accepted standards in social science research and can be used in further statistical analyses.

3.6.3 Instrument Validity

Validity is a measure of the accuracy of the inferences drawn from the data collected using a data collection instrument (Habib et al., 2014). There are three main types of validity: content, construct, and criterion validity. Construct validity is how accurately the data collected measures the intended variables, while content validity is whether the data collected represents the indicators for the variable being tested. To ensure this, the questionnaire was designed with sections representing each variable to be measured. Advice was sought from the supervisor to ensure that all relevant variables identified in the theoretical review were accurately measured. Criterion validity was established through the pilot testing.

3.7 Data Collection Procedure

First, the researcher secured research authorization for data collection from the Kenyatta University Graduate School and subsequently from the National Commission for Science, Technology, and Innovation (NACOSTI). Then the researcher visited the institutions within the target population to understand the organization's procedure for requesting permission for data collection. The researcher followed each institution's laid-down procedure for obtaining authorization to collect data. Where delays in approval for data collection, follow-up visits were made, and emails were sent. Once permission was granted, researchers visited the organization to drop off the questionnaires.

The questionnaires were either left with the individual researchers or at a central office, where they could be distributed to the scientists when available. They were scheduled to be collected after five

working days. However, this proved impractical due to prevailing circumstances such as the lecturers' strike. As a result, the researcher had to intensify follow-ups while allowing reasonable time for each organization. Reminder emails were sent to prompt the respondents to complete the questionnaires. Consequently, the data was collected over three months.

3.8 Data Analysis and Presentation

This section outlines how the data collected was analyzed and presented. It highlights both quantitative and qualitative data analysis. After collection, the data were screened for clarity, accuracy, and wholeness. The data was then analyzed quantitatively and qualitatively, in alignment with the study objectives. The quantitative data from closed-ended questions were edited, coded, and classified. The data was then analyzed using SPSS version 30.0 to obtain descriptive statistics. An initial exploratory analysis generated a frequency distribution enabling the computation of descriptive statistics, such as mean and standard deviation. This facilitated the description of the study sample, and data visualization techniques such as tables, charts, and graphs were used to present the results.

Inferential statistics was employed to test the relationships between the variables. This helps to generalize the results obtained to the general population (Mugenda & Mugenda, 2019). Correlation was used to establish the linearity of the relationship between the predictors and the outcome variable. A negative correlation coefficient was interpreted to mean an inverse relationship, while a positive coefficient meant the variables moved in the same direction, suggesting a direct

association. A coefficient close to +1 was interpreted to mean the variables were strongly and directly related, while a coefficient close to -1 meant the variables were strongly but indirectly related. A coefficient close to zero was interpreted to mean weak or no correlation between the variables. (Mugenda & Mugenda, 2019)

Regression analysis was carried out to estimate the effect of the independent variables upon the dependent variable using the multiple linear regression model below;

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \varepsilon$$

Where;

Y = Commercialization of Agri-biotechnology crop innovations

β_0 = The constant i.e., the value of Y when X_1 , X_2 , X_3 and X_4 are all zero

β = Regression constants of the various independent variables

X_1 = Strategic Entrepreneurial Mindset

X_2 = Entrepreneurial Culture

X_3 = Strategic Entrepreneurial Leadership

X_4 = Strategic Resource Management

ε = Error term

Open-ended responses were thematically analyzed to extract key themes. This involved a systematic process of familiarizing oneself with the data, coding significant features, and

identifying recurring patterns across the dataset. Initial codes were generated and organized into overarching themes that captured key concepts relevant to the research objectives. The researcher analyzed the responses to uncover underlying themes and patterns, which were then systematically categorized into meaningful clusters.

3.9 Ethical Consideration

A letter of introduction was obtained from Kenyatta University to introduce the researcher to the respondents. Before administering the questionnaire, voluntary consent was secured from the respondents after clearly explaining the study's aim and relevance. The informed consent included a clause allowing respondents to discontinue participation in the study without consequences. Participants were explicitly guaranteed strict confidentiality, with all collected data anonymized. The research did not collect personal identifiers for the respondents. The questionnaire did not require the respondents to reveal any intellectual property or confidential information about the research activities of their organizations. Respondent data was stored in a password-protected folder on the researcher's laptop, only accessible to the researcher. The researcher maintained high integrity when writing the research report, and all ideas borrowed from other scholars were appropriately cited and referenced. The researcher also observed all ethical requirements provided by NACOSTI.

CHAPTER FOUR: RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

This chapter outlines the findings of this study and their discussion. It includes the response rate, demographic characteristics, descriptive analysis of the study variables, diagnostic tests for the empirical model, inferential analysis, and qualitative data analysis.

4.2 Response Rate

The study aimed for a sample of 72 scientists. The response rate is shown in Table 4.1 below.

Table 4.1 Response Rate

| Description | Frequency | Percentage |
|----------------------|------------------|-------------------|
| Response | 46 | 64% |
| Incomplete Responses | 8 | 11% |
| Non-response | 18 | 25% |
| Total | 72 | 100% |

Source: Research Data (2025)

The researcher distributed 72 questionnaires to scientists within the available target institutions involved in Agri-biotechnology crop innovation R&D. Out of these, 54 questionnaires were filled out and returned. However, 8 questionnaires were deemed to have a lot of missing data and were excluded from the study. Only 46 responses were used in this study for data analysis. This translated to a response rate of 64%. According to Mugenda & Mugenda (2019), self-administered questionnaires tend to have a low response rate, and data analysis proceeded with the achieved > 60% rate, meeting adequacy thresholds. Early and late responses were compared, and the

comparison did not reveal a statistically significant difference. Therefore, the response rate was deemed acceptable for proceeding with data analysis.

4.3 Demographic Characteristics

This sub-section represents the socio-demographic profile of the study participants. It includes gender, type of organization, the position held, and the number of years the respondents have undertaken Agri-biotechnology R&D.

4.3.1 Gender

This subsection presents the gender of the study participants.

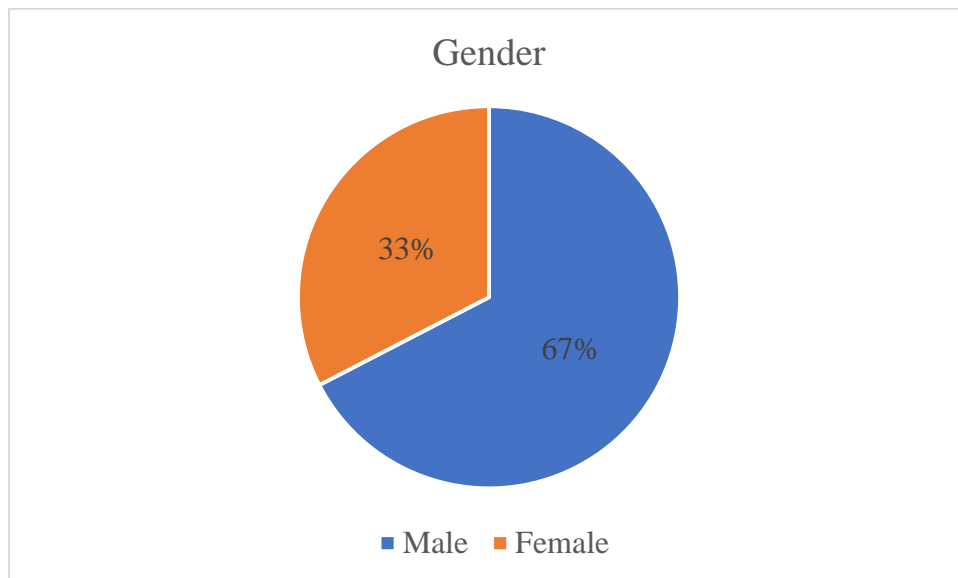


Figure 4.1 Gender

Source: Research Data (2025)

The study employed 46 participants, consisting of 31 (67.4%) males and 15 (32.6%) females ($N=46$). Agribiotech-related fields show evidence of male gender domination as revealed through the survey results.

4.3.2 Type of Organization

The table below presents the types of organizations involved in the study and the distribution of the study participants.

Table 4.2 Distribution of Respondents by Type of Organization

| Type of Organization | Frequency | Percent |
|------------------------------|------------------|----------------|
| Academic Institutions | 33 | 71.7 |
| National Research Institutes | 8 | 17.4 |
| Private Organizations | 5 | 10.9 |
| Total | 46 | 100.0 |

Source: Research Data (2025)

Most participants (71.7%) were associated with academic institutions, while respondents from national research institutes comprised 17.4%. Eleven percent (11%) of the respondents were from private commercial and non-commercial organizations. The responsible function of academic institutions remains vital for developing and researching in the field of agribiotech.

4.3.3 Position Held in the Organization

The study participants held different positions within their organizations, as shown in Table 4.3 below.

Table 4.3 Position Held in the Organization

| Position | Frequency | Percent |
|-----------------------------|------------------|----------------|
| Postgraduate students | 11 | 23.9 |
| Researchers | 10 | 21.7 |
| Academic staff | 7 | 15.2 |
| Administrators | 6 | 13.0 |
| Technicians & Technologists | 9 | 19.6 |
| Founder | 2 | 4.4 |
| Program Assistant | 1 | 2.2 |
| Total | 46 | 100.0 |

Source: Research Data (2025)

The study participants maintained different organizational positions. Most respondents were master's students, representing 17.4% of the total, while lecturers and technicians comprised 8.7% of the participant base each. Research assistants and research scientists comprised 4.3% of the workforce among several different industry roles they studied. Postgraduate students made up the largest proportion of respondents at 11, with 8 (17.4%) being master's students, 1 (2.2%) doctorate students, and 2 (4.3%) master's student interns. They were followed by researchers at 10, with 3 (6.5%) researchers, 3 (6.5%) senior researchers, a post-doctorate researcher, and 2 (4.3%) research scientists. There were 7 academic staff members, including 4 (8.7%) lecturers, 2 (4.3%) senior lecturers, and an associate professor. Six administrators took part in the study. There were 9 technicians and technologists: 4 (8.7%) technicians, 2 (4.4%) technologists, a senior technologist, and 2 (4.4%) chief technologists.

Other participants were 2 (4.3%) founders of private commercial organizations and a program assistant with a national agricultural institute. As shown in Figure 4.3 above, survey respondents held different job positions. Including respondents from various organizational levels helps minimize disparities in perception and self-reporting bias while reflecting real-world diversity in the Agri-biotechnology industry. This, in turn, enhances the external validity of the study. The involvement of individuals from different levels of academia and research reflects strong university engagement in Agri-biotechnology R&D.

4.3.4 Years in Agri-biotechnology R&D

The research participants showed diverse experience levels as shown in Table 4.4 below.

Table 4.4 Years in Agri-biotechnology R&D

| Years | Frequency | Valid Percent | Cumulative Percent |
|--------------|------------------|----------------------|---------------------------|
| 0-3 | 11 | 24.4 | 24.1 |
| 4-7 | 14 | 31.1 | 55.6 |
| 7-12 | 7 | 15.6 | 71.1 |
| Above 12 | 13 | 28.9 | 100 |
| Total | 45 | 100.0 | |

Source: Research Data (2025)

Table 4.4 shows that research participants are involved at different stages of engagement in Agri-biotechnology R&D. Most (31.1%) had worked in the industry for 4-7 years. Experienced professionals with over 12 years of experience constituted a significant portion (28.9%) of the respondents. The results reflect a balanced mix of early-career and experienced researchers within the industry.

4.3.5 Type of Crops

Figure 4.2 below shows the types of crops on which the study participants' research focused.

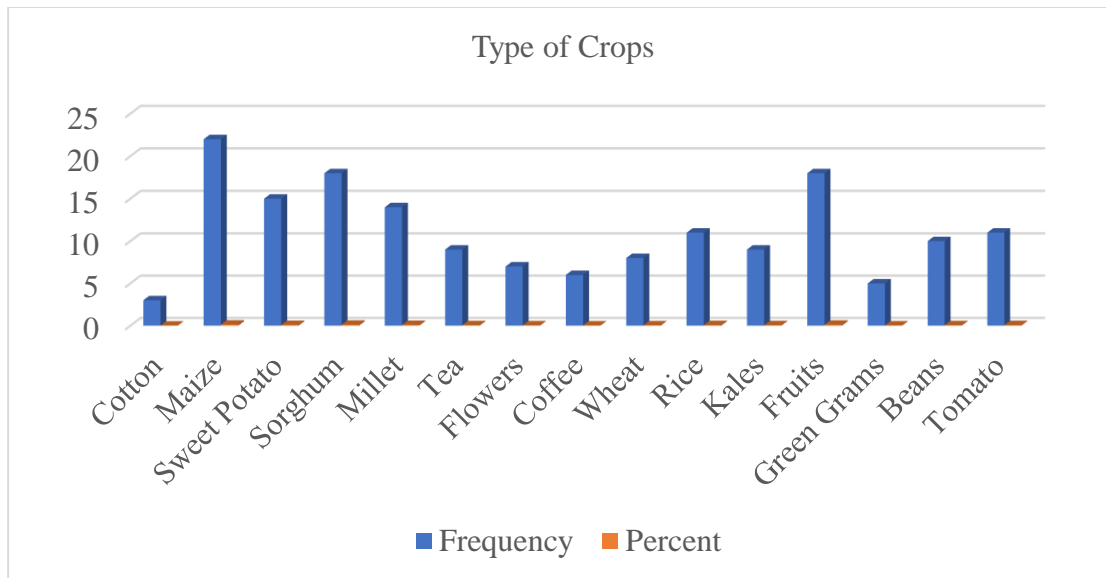


Figure 4.2 Types of Crops

Source: Research Data (2025)

The data revealed that approximately 84.9% of Agri-biotechnology crop innovations focused on food crops, like maize, sorghum, millet, rice, beans, and tomatoes, highlighting the global priority of enhancing food security. As shown in Figure 4.2 below, most of the respondents were engaged in R&D innovations focused on maize (13.3%), sorghum (10.8%), and fruits (10.8%). In contrast, only 15.1% targeted cash crops. Specifically, cereal crops accounted for 44.0% of the Agri-biotechnology crop research, followed by 12.0% for vegetable crops, 10.8% for fruits, and 9.0% each for root and tuber crops, legumes, and beverage crops. The wide variety of crops can explain the high focus on crop innovations (75%) compared to livestock, as noted in some previous studies (Falconi, 1999).

4.3.6 Sources of Funding

The table below shows the sources of funding for agribiotechnology crop research.

Table 4.5 Sources of Funding

| Source of Funding | Mean |
|---|-------------|
| Internal Organizational Sources | 1.56 |
| Collaboration with other Agri-biotechnology firms | 1.67 |
| Government Funding | 1.63 |
| Donor Funding | 2.25 |
| Overall | 1.78 |

Source: Research Data (2025)

Respondents indicated that their crop innovation activities were frequently financed through donor funding (Mean = 2.25). Other funding sources were less common, including collaboration with other Agri-biotechnology firms (Mean = 1.67), government funding (Mean = 1.63), and internal organizational sources (Mean = 1.56). Overall, the study findings revealed inadequate funding for Agri-biotechnology crop research and development, consistent with reports by Falconi (1999) and Ozor (2015). The findings also revealed an overreliance on donor funding and inadequate funding by the individual organizations. Ateka (2021) found almost similar results, with donor funding being the predominant source of financing, followed by internal organizational funds and government funding.

4.4 Descriptive Analysis of Study Variables

The key attributes of the study variables are provided in a comprehensive overview herein. The study adopted strategic entrepreneurial mindset, entrepreneurial culture, strategic entrepreneurial leadership, and strategic resource management as the independent variables. Quantitative data was collected using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) to measure each target variable. The researcher analyzed the responses to obtain the mean and standard deviation for each statement, which were tabulated separately, followed by an interpretive discussion.

4.4.1 Strategic Entrepreneurial Mindset and Commercialization of Agri-biotechnology Crop Innovations

The research aimed to examine the effect of strategic entrepreneurial mindset on commercialization among organizations involved in Agri-biotechnology crop innovations. This variable was conceptualized as a set of attitudes, perceptions, and motivations driving opportunity recognition and development in the field of Agri-biotechnology R&D. The researcher investigated various elements of the strategic entrepreneurial mindset: attitude, perception, opportunity recognition, motivation, and commitment and dedication, as presented in Table 4.6 below.

Table 4.6 Strategic Entrepreneurial Mindset

| Statement | Mean | Std. Dev. |
|---|-------------|------------------|
| It is important to put agricultural innovations on the market | 4.67 | 0.732 |
| I only engage in R&D activities that will have a return on investment | 3.52 | 0.809 |
| I am passionate about bringing innovations to the market | 4.67 | 0.634 |

| | | |
|--|-------------|--------------|
| The organization/institution encourages me to put my R&D outputs into the market | 3.85 | 1.074 |
| I am motivated by other scientists who have put their innovations on the market | 4.20 | 0.980 |
| I dedicate a lot of time to marketing Agri-biotech innovations | 3.24 | 0.947 |
| I remain disciplined when pursuing new opportunities | 4.24 | 0.899 |
| Overall Score | 4.06 | 0.733 |

Source: Research Data (2025)

The respondents agreed that it is important to bring their Agri-biotechnology crop innovations to the market (Mean = 4.67, SD = 0.732), and they expressed passion for doing so (Mean = 4.67, SD = 0.634). The respondents also agreed that they were motivated by other scientists who had put their innovations in the market (Mean = 4.20, SD = 0.980), and they remained disciplined in pursuing new opportunities (Mean = 4.24, SD = 0.733). However, the time dedicated to marketing their innovations was moderate (Mean = 3.24, SD = 0.947), probably because the respondents were also engaged in additional duties in their respective capacities within their organizations. Engagement in R&D activities with a clear return on investment yielded moderate results (Mean = 3.52, SD = 0.809), indicating that other factors also influenced the kind of R&D activities undertaken. These findings are aligned with findings from previous studies (Jemal, 2021; NawzadSabir et al., 2019; Roundy et al., 2018).

4.4.2 Entrepreneurial Culture and Commercialization of Agri-biotechnology Crop Innovations

Entrepreneurial culture was the second study variable. The research aimed to establish whether entrepreneurial culture drives the effective commercialization of Agri-biotechnology crop innovations. This variable was conceptualized as a set of collective ideals, skills, policies, and procedures that encourage the pursuit of Agri-biotechnology crop innovations. The study identified various elements of entrepreneurial culture: creativity and innovation, risk-taking, entrepreneurial intention, seeking competitive advantage, policies, and procedures. These are presented in Table 4.7 below.

Table 4.7 Entrepreneurial Culture

| Statement | Mean | Std. Dev. |
|--|-------------|------------------|
| Encourages creativity | 4.48 | 0.781 |
| Encourages taking risks to pursue innovations with huge investments and huge potential returns | 3.89 | 0.948 |
| Prioritizes R&D activities with commercial potential | 4.15 | 0.816 |
| Is clear about its support for researchers in Agri-biotech crop innovations throughout the whole process | 4.04 | 0.988 |
| Focus on creating value for the public | 4.26 | 0.929 |
| Seeks to outdo and stay ahead of other firms engaged in Agri-biotech crop R&D | 3.54 | 1.168 |
| Focused on developing products that are substantially different from existing products in the market | 3.96 | 0.918 |
| Has adopted policies that promote commercialization | 3.87 | 0.934 |
| Includes commercialization in the R&D process | 4.09 | 0.915 |

Overall Score

4.03

0.933

Source: Research Data (2025)

The respondents agreed that their organizations encourage creativity (Mean = 4.48, SD = 0.781), prioritize R&D innovations with commercial potential (Mean = 4.15, SD = 0.816), support researchers in Agri-biotechnology crop innovations (Mean = 4.04, SD = 0.988), focus on creating value for the public (Mean = 4.26, SD = 0.929), and include commercialization in their R&D processes (Mean = 4.09, SD = 0.915). The study also noted moderate agreement with other measures of entrepreneurial culture such as encouraging risk taking (Mean = 3.89, SD = 0.948), seeking to stay ahead of competitors (Mean = 3.54, SD = 1.168), focus on developing substantially unique products (Mean = 3.96, SD = 0.918), and promoting policies that promote commercialization (Mean = 3.87, SD = 0.934). Overall, the respondents agreed that an entrepreneurial culture existed within their organizations. These findings are supported by findings of previous studies (Maurset, 2020).

4.4.3 Strategic Entrepreneurial Leadership and Commercialization of Agri-biotechnology Crop Innovations

The research aimed to examine the effect of strategic entrepreneurial leadership on the commercialization of Agri-biotechnology crop innovations. It was conceptualized as a set of actions undertaken by organizations and their leaders to promote the pursuit and exploitation of Agri-biotechnology crop innovations. Table 4.8 below presents the features of the variables:

position, experience, role models, technology transfer office, and entrepreneurship support and training.

Table 4.8 Strategic Entrepreneurial Leadership

| Statement | Mean | Std. Dev. |
|---|-------------|------------------|
| The organization provides leadership in the commercialization of Agri-biotechnology innovations | 4.07 | 0.800 |
| I have role models who encourage me to pursue my innovations | 4.11 | 0.795 |
| The organization has a technology transfer office to assist researchers | 3.91 | 1.029 |
| The organization offers training on R&D to researchers | 4.07 | 1.041 |
| My position in the organization makes it easy to pursue my crop innovations to the end | 4.04 | 0.868 |
| Overall Score | 4.04 | 0.907 |

Source: Research Data (2025)

The mean values demonstrate a positive perception of strategic entrepreneurial leadership by the respondents about their organizations (Mean = 4.04, SD = 0.907). Role models who encourage Agri-biotechnology crop innovations had the highest response rate (Mean = 4.11, SD = 0.795), followed by organizational leadership (Mean = 4.07, SD = 0.800) and training on R&D to researchers (Mean = 4.07, SD = 1.041). The respondents also agreed that their positions in the organization allowed them to pursue crop innovations (Mean = 4.04, SD = 0.868). Generally, there was strong organizational leadership as measured by the specific variables. Maurset (2020) and Ndeisieh (2018) corroborate these findings.

4.4.4 Strategic Resource Management and Commercialization of Agri-biotechnology Crop Innovations

Strategic resource management was the fourth study variable. The research aimed to examine the effect of strategic resource management on the commercialization of Agri-biotechnology crop innovations. It was conceptualized as how an organization utilizes its resources to pursue opportunities in Agri-biotechnology crop innovations. The study identified the following variables as presented in Table 4.9 below;

Table 4.9 Strategic Resource Management

| Statement | Mean | Std. Dev. |
|---|-------------|------------------|
| Actively pursue donor funding for my innovations | 3.89 | 1.016 |
| Predominantly use existing organization resources | 3.89 | 1.215 |
| Consider the potential of an innovation before undertaking it | 4.11 | 0.994 |
| Consider my technical capacity before deciding to pursue an R&D innovation | 4.35 | 0.640 |
| Involve non-scientist professionals in their domains throughout all steps of R&D | 4.22 | 0.867 |
| Actively seek partnership and collaboration with other firms in the R&D of innovations. | 4.26 | 0.828 |
| Endeavors to keep my R&D activities confidential | 3.87 | 1.147 |
| Have access to knowledge resources from my organization | 4.28 | 0.958 |
| A part of networks that support Agri-biotechnology innovations | 4.11 | 0.994 |
| Overall Score | 4.11 | 0.962 |

Source: Research Data (2025)

Descriptive analysis revealed strong positive agreement (Mean = 4.11, SD = 0.962) across strategic resource management items. The respondents agreed that they consider the potential of an innovation and their technical capacity (Mean = 4.11, SD = 0.994 and Mean = 4.35, SD = 0.640, respectively), involve non-scientist professionals in their domains (Mean = 4.22, SD = 0.867), actively seek collaborations and partnerships (Mean = 4.26, SD = 0.828), have access to knowledge resources (Mean = 4.28, SD = 0.958), and are a part of networks that support Agri-biotechnology innovations (Mean = 4.11, SD = 0.994). There was also moderate agreement with the active pursuit of donor funding (Mean = 3.89, SD = 1.016), the predominant use of existing organization resources (Mean = 3.89, SD = 1.215), and keeping R&D activities confidential (Mean = 3.87, SD = 1.147).

4.4.5 Commercialization of Agri-biotechnology Crop Innovations

The study adopted commercialization as the dependent variable. This was conceptualized as the process by which firms introduce approved Agri-biotechnology innovations in the market and was operationalized through patents, out-licenses, and spin-offs or start-ups. The study identified the following variables as presented in Table 4.10 below.

Table 4.10 Commercialization

| Statement | Mean | Std. Dev. |
|---|-------------|------------------|
| Acquiring patents for your innovations | 0.39 | 0.577 |
| Acquiring rights to a product, technology, or intellectual property from another organization or researcher | 0.50 | 0.753 |
| Selling rights to a product, technology, or intellectual property to another organization or researcher | 0.26 | 0.491 |
| Formed a separate firm to pursue the commercialization of a successful innovation(s) | 0.26 | 0.612 |
| Overall Score | 0.35 | 0.608 |

Source: Research Data (2025)

The commercialization of Agri-biotechnology crop innovations was very low (Mean = 0.35, SD = 0.608). For example, patent acquisition had a mean of 0.39, indicating that only a small percentage of respondents were involved in securing patents, with moderate variability (SD = 0.577). More than 50% of the respondents reported not having acquired any patent for their R&D innovations ($N = 46$). Additionally, respondents were not actively acquiring (Mean = 0.50, SD = 0.753) or selling rights (Mean = 0.26, SD = 0.491) to Agri-biotechnology crop innovations. These findings suggest that the active commercialization of Agri-biotechnology crop innovations is uncommon. This may be attributed to challenges, such as bureaucracy and a lack of awareness.

These findings corroborate the findings by Ateka (2021), who reported that 75.5% of the university academic staff had not applied for patents for their innovations and that 85.5% had not commercialized their innovations in any way.

4.5 Inferential Analysis

Regression analysis was utilized to test the cause-and-effect relationship between strategic entrepreneurship and the commercialization of Agri-biotechnology crop innovations. The aim was to link the independent variables (strategic entrepreneurial mindset, entrepreneurial culture, strategic entrepreneurial leadership, and strategic resource management) and the commercialization of Agri-biotechnology crop innovations.

4.5.1 Model Summary

An analysis was conducted to determine the R-squared value, as presented in Table 4.11 below.

Table 4.11 Model Summary

| Model | R | R ² | Adjusted R ² | Std. Error of the Estimate | F Statistic | p-value |
|-------|-------|----------------|-------------------------|----------------------------|-------------|---------|
| 1 | 0.857 | 0.735 | 0.709 | 1.041 | 28.415 | < 0.001 |

Source: Research Data, 2025

The table shows that the adjusted coefficient of determination (Adjusted R²) is 0.709. This means that approximately 70.9% of the variance in the commercialization of Agri-biotechnology crop innovations in Nairobi City County, Kenya, can be explained by the four independent variables of strategic entrepreneurship: strategic entrepreneurial mindset, entrepreneurial culture, strategic entrepreneurial leadership, and strategic resource management. The relatively small residual errors (Standard Error of the Estimate = 1.041) suggest that, on average, the predicted values are close to the actual observed values. The F-statistic of 28.415 and a p-value less than 0.001 confirm that the

regression equation is statistically significant overall. The p-values for all coefficients were less than 0.05, meaning that the predictor variables significantly predicted the dependent variable. The findings confirmed that strategic entrepreneurship is a critical determinant in the successful commercialization of Agri-biotechnology crop innovations. It also revealed that 29.1% of the factors determining the commercialization of Agri-biotechnology crop innovations were not within the study's scope.

4.5.2 Correlation Analysis

Correlation coefficients were computed to examine the magnitude and nature of the associations between the independent and dependent variables. Table 4.12 below shows how strongly each independent variable influences the commercialization of Agri-biotechnology crop innovations in Nairobi City County, Kenya.

Table 4.12 Correlation Analysis

| Variables | Commercialization | Strategic Entrepreneurial Mindset | Entrepreneurial Culture | Strategic Entrepreneurial Leadership | Resource Management |
|-----------------------------------|--------------------------|--|--------------------------------|---|----------------------------|
| Commercialization | 1 | | | | |
| Strategic Entrepreneurial Mindset | .443** | 1 | | | |

| Variables | Commercialization | Strategic Entrepreneurial Mindset | Entrepreneurial Culture | Strategic Entrepreneurial Leadership | Resource Management |
|--------------------------------------|--------------------------|--|--------------------------------|---|----------------------------|
| Entrepreneurial Culture | .543** | -.018 | 1 | | |
| Strategic Entrepreneurial Leadership | .321* | .103 | .072 | 1 | |
| Strategic Resource Management | .512** | .018 | .152 | .024 | 1 |

*. Correlation is significant at the 0.05 level. **. Correlation is significant at the 0.01 level.

Source: Research Data, 2025

The results of the correlation analysis showed that the variables – commercialization, strategic entrepreneurial mindset, entrepreneurial culture, strategic entrepreneurial leadership, and strategic resource management – form a cohesive interconnected system with a statistically significant positive link between them. Commercialization was positively correlated with all four predictors. A clear linear relationship existed between commercialization and the two variables of entrepreneurial culture and strategic resource management ($r = .543$, $p < .01$, and $r = .512$, $p < .01$, respectively). Strategic entrepreneurial mindset and strategic entrepreneurial leadership had a moderate correlation with commercialization ($r = .443$, $p < .01$ and $r = .321$, $p < .05$, respectively).

However, this study revealed marginal, non-significant relations between the independent variables. Generally, the research findings demonstrate why organizations should implement strategic approaches combining leadership enhancement with resource management, mindsets, and organizational culture to achieve innovation commercialization. The data analysis confirmed linearity; hence, the data could be used to perform regression analysis.

4.5.3 Regression Coefficients

Multiple linear regression analysis was used to quantify the predictive relationships between the dependent and the predictor variables. It shows the extent of influence that the four variables of strategic entrepreneurship have on change in the commercialization of Agri-biotechnology crop innovations. The results are shown in Table 4.13 below.

Table 4.13 Regression Coefficient

| Variable | Unstandardized Coefficients (B) | Standardized Coefficients (β) | t-value | p-value |
|--|--|---|----------------|----------------|
| Constant (β_0) | -0.326 | – | -0.456 | 0.651 |
| Strategic Entrepreneurial Mindset (X_1) | 0.681 | 0.420 | 5.191 | 0.000 |
| Entrepreneurial Culture (X_2) | 0.739 | 0.469 | 5.743 | 0.000 |
| Strategic Entrepreneurial Leadership (X_3) | 0.388 | 0.234 | 2.885 | 0.006 |
| Strategic Resource Management (X_4) | 0.699 | 0.428 | 5.257 | 0.000 |

Source: *Research Data, 2025*

From the above data, the resultant regression equation is;

$$Y = -0.326 + 0.681X_1 + 0.739X_2 + 0.388X_3 + 0.699X_4 + \varepsilon$$

Where;

Y = Commercialization of Agri-biotechnology crop innovations

X₁ = Strategic Entrepreneurial Mindset

X₂ = Entrepreneurial Culture

X₃ = Strategic Entrepreneurial Leadership

X₄ = Strategic Resource Management

ε = Error term

Strategic entrepreneurial mindset is one of the factors driving successful commercialization of Agri-biotechnology R&D outputs ($\beta = 0.681$, $p < 0.05$). Scientists' attitudes, perceptions, commitment, and motivation for the commercialization of their crop innovations enhance the achievement of better results when bringing their innovations to market. Previous studies have shown that having an entrepreneurial mindset increases research funding, which promotes the commercialization of technology innovations (Gupta *et al.*, 2018). Hayter *et al.* (2022) identified entrepreneurial motivation as one of the factors promoting the development of commercialization-focused entrepreneurial identity among scientists. NawzadSabir *et al.* (2019) also found that the need for achievement, commitment, and determination significantly influenced the

commercialization of knowledge and innovations. This investigation's outcomes mirror those from these previous studies.

The findings suggest that entrepreneurial culture had the most significant positive influence on the commercialization of Agri-biotechnology crop innovations ($\beta = 0.739$, $p < 0.05$). Organizations with policies and procedures encouraging creativity and risk-taking achieve greater commercialization of Agri-biotechnology crop innovations. Entrepreneurial culture strengthens both innovation and business competitiveness, distinctive product creation, and leads to productive commercialization procedures. Tijani *et al.* (2020) and NawzadSabir *et al.* (2019) found that a firm's performance and research commercialization, respectively, had a linear dependence on strategic entrepreneurship, as measured through innovation and risk-taking. These previous studies align with the current study in demonstrating the beneficial influence of organizational entrepreneurial culture on the commercialization of R&D innovations.

Strategic entrepreneurial leadership had the lowest yet meaningful influence on commercialization activities ($\beta = 0.388$, $p < 0.05$). Research achievement occurs under exceptional leadership because these leaders establish entrepreneurship support programs, such as training programs and technology transfer offices. Having role models who have engaged in Agri-biotechnology crop innovation commercialization provides a source of guidance and motivation. Maurset (2020) determined that role models foster a culture of entrepreneurship, which enhances research commercialization, while Johnson *et al.* (2022) established the positive impact of training on the commercialization of R&D outputs. Gachuhi (2021) also showed the role of years of experience

in successful commercialization. All these studies agree with the findings of the current study regarding the positive impact of strategic entrepreneurial activities on the commercialization of crop innovations.

Strategic resource management was the second most influential variable ($\beta = 0.699$, $p < 0.05$). Successful commercialization of Agri-biotechnology crop innovations depends on the ability of organizations to properly manage their resources, such as technical capacity, networks, and knowledge assets. Strategic factors involved in funding, partnership building, and research confidentiality together drive successful commercialization outcomes. These results reinforce previous conclusions by Nyende *et al.* (2013) on the influence that human capacity, funding, and modern equipment have on the commercialization of Agri-biotechnology R&D outputs. Ateka (2021) also identified inadequate funding and a lack of industry-university collaboration as factors that lead to low commercialization of agricultural innovations.

4.6 Qualitative Data

Quantitative data was collected through semi-structured questions in the questionnaire. These focused on the challenges impeding the commercialization of Agri-biotechnology crop innovations and potential solutions. A thematic content analysis was conducted to identify recurring themes related to these challenges and the proposed remedies. The study objectives align closely with these themes, highlighting institutional barriers to effectively commercializing Agri-biotechnology crop innovations. The six major themes that emerged from the analysis are summarized in Table 4.14, alongside their sub-themes and descriptions.

Table 4.14 Summary of Themes and Sub-Themes

| Themes | Sub-Themes | Description |
|----------------------------------|--|--|
| Bureaucracy | Regulatory bureaucracy Patenting process constraints Long approval process Expensive regulations | Most respondents encountered bureaucracy in the regulatory processes. |
| Financial Constraints | High costs High fees Inadequate funding Inability to retain staff Few instruments/equipment Inadequate capacity | Respondents reported high production costs with inadequate financial support |
| Knowledge and Awareness Gaps | Lack of awareness by researchers Knowledge bias and gaps Rapid technological developments Limited networking opportunities | Some researchers decried the lack of awareness about opportunities and changes in the field. |
| Regulatory and Policy Challenges | Punitive regulations No guidelines for the communication of R&D outputs Lack of government support Problem in getting the standardization marks Packaging guidelines Weak structure Limitations on public officers | Some scientists reported unsupportive regulations and policy frameworks. |

| | | |
|----------------------------------|--|---|
| Poor Public Perception | Poor public perception Lack of public awareness Culture | Scientists felt constrained by the wrong public perception of their research. |
| Market Access and Trade Barriers | Limited market access Challenges in market entry Unpredictable environment | Researchers reported having erratic trade and market opportunities. |

Source: Research Data (2025)

The analysis revealed bureaucracy as the principal theme. Regulatory bureaucracies coupled with high costs constitute major barriers to the commercialization of Agri-biotechnology crop innovations. This was identified through responses, such as “bureaucracy”, “patenting constraints”, “elaborate approval processes”, “expensive regulations”, “high costs”, and “high fees”. Inflexible regulatory and approval processes reduce motivation and slow down the commercialization process. This obstacle has been extensively documented as a significant impediment to commercializing Agri-biotechnology innovations (Kedisso, Barro, et al., 2022). Ateka (2021) also identified similar challenges, with 63.3% of the respondents noting that the regulatory procedures hindered market entry and that the costs were prohibitive. The respondents proposed four key solutions: streamlining approval processes, easing regulations, and eliminating administrative barriers. Simplification of regulatory processes and reduced taxation will quicken market entry and enhance commercialization.

“Funding gaps” and “financial constraints” were consistently identified throughout the thematic analysis. Resources for funding are limited, and institutional financial frameworks remain

insufficient. The “lack of adequate financial support” derails the R&D process and restricts market entry. The findings highlight a clear need for financial investment. Similar findings have been made by Ozor (2015) and Odame (2014). In a content analysis by Nyende et al. (2013), 35% of the factors reported to inhibit Agri-biotechnology R&D were financial factors, such as inadequate funding, capacity, and equipment. To address this, the proposed strategies emphasized securing funding through collaborative partnerships. It was also proposed that “government support should be increased” to enhance research facilities and support research programs. Odeny (2010) had proposed similar strategies, such as increased public funding and enhanced collaborative efforts. A competitive Agri-biotechnology industry relies on effectively closing these funding gaps.

The findings revealed that “gaps in knowledge” and awareness represent a significant barrier to the commercialization of Agri-biotechnology crop innovations. The lack of essential knowledge prevents scientists from developing market-oriented innovations. Ozor (2015) and Ateka (2021) noted that the lack of awareness delayed the commercialization of genetically modified crops, recommending increased capacity building and training of stakeholders. Addressing this issue requires both “capacity-building programs” and improved “information dissemination”. Such programs enhance strategic entrepreneurial practices, positioning commercialization as an integral component of the R&D process.

Regulatory and “policy challenges” are also obstacles to commercializing Agri-biotechnology crop innovations. “Ambiguous regulatory guidelines” and policies have led to uncertainties in the commercialization process. Nyende *et al.* (2013) cited unclear policies, corruption, and

government interference as policy and process challenges. Nagarajan *et al.* (2016) also reported similar policy barriers. The respondents proposed solutions such as “creating awareness about intellectual property rights”. Establishing “clear and effective market regulations” would foster confidence among investors, leading to sustainable commercialization efforts. Previous studies also noted that the most common concerns raised by stakeholders were unclear regulatory processes and policies (Ozor, 2015).

“Poor public perception” has substantially hindered the uptake and implementation of Agri-biotechnology crop innovations. Consumers’ hesitation to adopt Agri-biotechnology crops stems from the potential health risks and environmental damage. “Public doubts” about genetically modified crops delay their commercialization and consumer adoption. Similar challenges were reported by Ozor (2015), noting that the public had safety, ethical, and socio-economic concerns. To address this, awareness campaigns to counter misperceptions and disseminate information on safe Agri-biotechnology methods and benefits are essential. Educating the public with “credible information” will enhance awareness, creating suitable conditions for commercialization success. Other scholars have noted that addressing these concerns is critical to enhancing the adoption and commercialization of Agri-biotechnology crop innovations (Masehela & Barros, 2023).

Market access and trade barriers emerged as key thematic concerns. The limited growth in the sector is due to scientists’ “lack of sufficient market linkages” and “commercialization networks”. Agri-biotechnology entrepreneurs face difficulties entering competitive markets due to “restrictive policies” and limited resources. Kedisso *et al.* (2022) reported that trade barriers contributed to

2.8% of the challenges faced by stakeholders across Sub-Saharan Africa. To address these barriers, the respondents identified “training and marketing support” as key solutions. There is a need to expand market access to create more trade opportunities. Government support and “political goodwill” are also essential, as suggested by Masehela & Barros (2023). Loganathan et al. (2022) proposed that these can be achieved through entrepreneurial networks and agricultural knowledge systems.

CHAPTER FIVE: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Introduction

This chapter highlights the summary of study findings and offers a conclusion. It also outlines contributions to knowledge, recommendations on policy and practice, and suggestions for further research.

5.2 Summary

The study was founded on the observation that few Agri-biotechnology crop innovations have been commercialized in Kenya. Therefore, it aimed to evaluate the effect of strategic entrepreneurship on the commercialization of Agri-biotechnology crop innovations in Nairobi City County, Kenya. The study used a descriptive research design, and data was collected from 46 scientists involved in crop innovations. Demographic data was analyzed to describe the status of the Agri-biotechnology industry. The study examined the effect of strategic entrepreneurial mindset, entrepreneurial culture, strategic entrepreneurial leadership, and strategic resource management on commercialization through descriptive analysis of the variables and inferential analysis. A thematic analysis of the qualitative data was also performed. This section presents a summary of the key findings.

The study first sought to evaluate the impact of a strategic entrepreneurial mindset on the commercialization of Agri-biotechnology crop innovations among organizations in Nairobi City County, Kenya. Results from the multiple linear regression analysis indicated that a strategic

entrepreneurial mindset exerted a substantial positive influence on the commercialization outcomes in the Agri-biotechnology industry. The variable also had a moderate correlation with commercialization. Descriptive analysis of the variable revealed a high level of agreement with the importance of passion, motivation, and discipline among researchers in enhancing commercialization.

The second study objective was to determine the effect of entrepreneurial culture on commercialization of Agri-biotechnology crop innovations in selected organizations in Nairobi City County, Kenya. The descriptive analysis revealed that the respondents strongly agreed that their organizations encourage creativity, innovation, risk-taking, and entrepreneurial intention, and they have clear policies and procedures. The pro-innovation cultural factors exhibited a robust positive association with commercialization outcomes. The regression analysis also revealed that entrepreneurial culture had the most significant positive influence on the commercialization of Agri-biotechnology crop innovations.

The third study objective sought to find out the effect of strategic entrepreneurial leadership on the commercialization of Agri-biotechnology crop innovations in selected organizations in Nairobi City County, Kenya. A descriptive analysis of this variable showed a strong presence of technology transfer office, role models, entrepreneurship support, and training. Strategic entrepreneurial leadership showed a moderate correlation with commercialization. The multiple regression analysis revealed the lowest but still meaningful influence on commercialization.

The study's culminating objective focused on how strategic resource governance influences commercialization success among organizations involved in Agri-biotechnology crop innovations in Nairobi City County, Kenya. This was also investigated through descriptive analysis of the variable as well as inferential analysis. The descriptive analysis revealed a strong pursuit of donor funding, strategic partnerships, and networking opportunities. The respondents strongly agreed with the importance of involving non-scientists in their domains, managing organizational resources, and considering one's technical capacity. Strategic resource management showed a significant positive influence on the commercialization of Agri-biotechnology crop innovations.

The study also sought to understand the challenges faced by Agri-biotechnology crop researchers and the probable solutions. This data was collected through qualitative questions and analyzed by thematic analysis. The study identified the following thematic areas as the major challenges: regulatory bureaucracy, funding gaps, knowledge and awareness gaps, ambiguous policies, poor public perception, and market access and trade barriers. The respondents proposed that these challenges can be addressed by streamlining regulatory approval processes, reducing trade barriers, increasing public funding, enhancing collaborations, clarifying market regulations, and increasing government support.

The study considered the demographic data collected to be useful in describing the current status of Agri-biotechnology crop innovation commercialization in Kenya. The respondents exhibited diversity in their demographic characteristics, such as gender, type of organization, years spent in Agri-biotechnology research, and positions held within their organizations. The findings were

reported through frequencies and percentages. The findings revealed that most crop innovations were carried out on food crops. Maize, sorghum, fruits, and sweet potatoes were the most common. There was negligible focus on cash-generating crops. These research activities were also largely financed through donor funding, with inadequate government or internal organizational financing.

5.3 Conclusion

This study set out to examine the influence of strategic entrepreneurship on the commercialization of Agri-biotechnology crop innovations among selected organizations in Nairobi City County, Kenya. Based on both theoretical frameworks and empirical evidence, it was established that strategic entrepreneurship has a statistically significant and positive effect on commercialization outcomes in this sector.

Specifically, the four dimensions of strategic entrepreneurship—strategic entrepreneurial mindset, entrepreneurial culture, strategic entrepreneurial leadership, and strategic resource management—were shown to be key enablers of commercialization. While all dimensions demonstrated a positive impact, strategic entrepreneurial leadership showed the least influence, albeit still statistically significant. This suggests that leadership, although important, may not operate in isolation but rather as part of integrated strategic entrepreneurial practices.

From these findings, it was concluded that organizations seeking to improve the commercialization of Agri-biotechnology crop innovations should actively cultivate strategic entrepreneurial

practices. Such practices not only enhance organizational adaptability and innovation capacity but also strengthen market orientation.

5.4 Contributions to Knowledge

The general objective of this study was to investigate the effect of strategic entrepreneurship on commercialization among organizations involved in Agri-biotechnology crop innovations. The study found a significant positive influence of strategic entrepreneurial practices on the commercialization of crop innovations. Therefore, this study contributes to the empirical literature on the influence of strategic entrepreneurship on commercialization. It also offers insights into the specific strategic entrepreneurial practices, namely, strategic entrepreneurial mindset, entrepreneurial culture, strategic entrepreneurial leadership, and strategic resource management.

The study contributes to the pool of knowledge by providing empirical data on strategic entrepreneurship. It provides empirical evidence on how strategic entrepreneurship has been embraced in the Agri-biotechnology industry in Kenya and the extent of its use. The concept of strategic entrepreneurship is relatively new, with most of the previous studies being done in developed countries. Conducting this study in Kenya shows that the concept is gaining traction globally. The conceptual framework also offers valuable insights on the measurement of the construct.

The study describes the current status of Agri-biotechnology crop innovations in Kenya, including the status of commercialization of the innovations. The findings present a detailed demographic

characterization of the industry, including the major players, crops involved, and research funding. It also highlights the challenges currently being faced in the industry. It highlights the commercialization status of the innovations and provides quantitative data on the barriers to commercialization. As such, this study provides empirical data on Kenya's Agri-biotechnology industry.

Further, the study supports the propositions advanced by the technology commercialization theory, strategic entrepreneurship theory, knowledge spillover theory, and the theory of traditional agriculture. It presents an example of firms failing to commercialize their innovations as advanced by the technology commercialization theory. It highlights the nexus between entrepreneurship, innovation, and strategic management as proposed by the strategic entrepreneurship theory. It looks at knowledge as a factor of production and a strategic asset based on the knowledge spillover theory. Lastly, it identifies Agri-biotechnology as one of the ways of modernizing agriculture, as advanced by the theory of traditional agriculture.

5.5 Recommendations and Policy Implications

Based on the findings and the conclusion, the study offers several recommendations for the research organizations and policymakers. First, the study recommends that organizations involved in Agri-biotechnology crop innovations embrace strategic entrepreneurial practices in their research and development. The directors should ensure that strategic entrepreneurial practices are incorporated in their strategic plans to enhance commercialization as an output. They should also

be included in their research and development procedures to increase market-oriented innovations and encourage researcher to patent their innovations. The organizations should intentionally build a culture of entrepreneurial support for their researchers by offering incentives to researchers who successfully commercialize their innovations.

The directors and finance managers should allocate a specific and adequate proportion of their budget to support the commercialization of innovations. These funds should be channeled to create and equip technology transfer offices to assist their researchers in processing in- and out-licenses. The funds should also be used to organize training sessions for their researchers on entrepreneurial skills and the available commercialization pathways. Lastly, the funds can procure the required equipment and human capital to support crop research and development activities.

The deans and heads of departments in academic institutions should also work closely with the Deputy Vice Chancellor in charge of research to create collaborative frameworks with individual researchers and private organizations. The deans of schools and heads of departments should also seek donor funding to equip their faculties and departments with the required equipment and instruments. This will encourage more post-graduate students to pursue their research and increase the number of researchers seeking collaboration with the departments.

Research scientists should pursue strategic partnerships with academic institutions and the public agricultural research institutes to enhance their capacity to innovate, develop, and commercialize their outputs. They should join existing networks for agricultural research and development. This

will allow them to harness the knowledge within the networks in their research activities. It will also enhance collaboration while seeking donor funding.

The Principal Secretary in the State Department of Agriculture, in collaboration with the Director of the Plant Protection & Food Safety Directorate, should actively engage the public on the safety of Agri-biotechnology crop innovations. Public relations engagements and media campaigns should be held to inform the public about genetically modified crops. This will go a long way in changing public perception and inspiring the public's confidence in these agricultural innovations. The ministry should also organize an exchange program between the local industry players and countries with well-established Agri-biotechnology industries, such as the United States of America, Canada, Brazil, and Argentina. This will help the local industry players to build useful networks.

The National Biosafety Authority should review its regulatory procedures to make them easy for the industry players to understand. This should be incorporated into the authority's strategic plan to ensure responsiveness to customers' needs. The authority should also organize an interactive session with the industry players to clarify their regulatory procedures and collect feedback. This will aid in identifying areas of bottlenecks that need to be reviewed and how to streamline their regulatory processes.

Finally, the government of Kenya should increase the budgetary allocation for agricultural research and development. Increased public funding will help build modern research facilities and provide

the necessary physical facilities and human resources. The government should support Agri-biotechnology research programs through grants, tax incentives, training, and scholarships for researchers.

5.6 Suggestions for Further Research

The study investigated the effect of strategic entrepreneurship and commercialization of Agri-biotechnology crop innovations in selected organizations in Nairobi City County, Kenya. As such, the study was limited to the Agri-biotechnology industry and biased towards crops. Future studies can be carried out in other industries to validate the results of this study. Even within the industry, livestock and microbial innovations can also be explored. Future research can also focus on operational definitions of the current study variables to test the generalizability and robustness of the study findings.

The current study employed a cross-sectional study design. This cannot establish causality or changes in commercialization over time. A longitudinal study may be considered to study organizations implementing strategic entrepreneurial practices for causality assessment and to track evolutionary changes over time. The study recruited researchers at all levels, including research assistants. It was also done across 3 target areas: academic institutions, public agricultural research institutes, and private organizations. This led to heterogeneity in the results, as shown by the large standard deviations. This study recommends that future research be limited to industry

experts and one target practice area. This will help validate the results of this study while addressing any systemic bias and dilution of effects among smaller sub-groups.

The study reported very low levels of commercialization in the Agri-biotechnology industry. It relied on market orientation, interdisciplinary teams, patents, out-licenses, and spin-offs to measure commercialization. The low levels of commercialization can be validated in future research using alternative measures. Additionally, the data collection instrument was developed and used for the first time in the Kenyan setting and the Agri-biotechnology industry. Some variables reported moderate reliability. Future research can test the data collection tool in other countries and industries.

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APPENDIX I: QUESTIONNAIRE

SECTION A – DEMOGRAPHIC INFORMATION

1. Gender

Male Female

2. Name of Organization/Institution/Firm: _____

3. Position held in the organization: _____

4. Type of Organization (Tick the most appropriate)

a. Public institution

University

National Institute for Agricultural Research

b. Private Organization

Private Commercial

Private non-commercial (NGO, Foundation)

5. Number of years the respondent has been undertaking Agri-biotechnology research.

0–3years 4 – 7years 7 – 12years

Above 12years

6. Type(s) of Agri-biotechnology research and development the organization is involved in.

(Tick all that apply)

Crops Animal Microbial

SECTION B – STATUS OF THE COMMERCIALIZATION OF AGRIBIOTECHNOLOGY CROP INNOVATIONS

1. How many researchers does the organization have at each level?

| | 0 – 5 | 6 – 10 | 11 – 15 | 16 – 20 | 21 – 25 |
|-----------------------------|-------|--------|---------|---------|---------|
| Research Assistants | | | | | |
| Research Scientist I | | | | | |
| Research Scientist II | | | | | |
| Senior Researcher | | | | | |
| Principal Researcher | | | | | |
| Senior Principal Researcher | | | | | |

2. From which of these sources has the organization received funding for Agribiotechnology R&D? (*Tick where appropriate*)

1 – Never 2 – Rarely 3 – Sometimes 4 – Often 5 – Very Often

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Internal Organizational sources | | | | | |
| In Collaboration with other Agribiotechnology firms | | | | | |
| Government funding | | | | | |
| Donor Funding | | | | | |

3. Which of the following crops have you participated in R&D on? (*Tick whichever applies*)

Cotton Maize Sweet Potatoes Sorghum Millet

- Tea Flowers Coffee Wheat Rice
 Kales Fruits Green Grams Beans Tomatoes

Others (Please specify): _____

4. Which of the following crops are your R&D activities currently focused on? (Tick whichever applies)

- Cotton Maize Sweet Potatoes Sorghum Millet
 Tea Flowers Coffee Wheat Rice
 Kales Fruits Green Grams Beans Tomatoes

Others (Please specify): _____

5. Which of the following crop traits are you currently focused on? (Tick all that apply)

- Drought-tolerance Insect/Pest-resistance Higher crop yield
 Herbicide/Pesticide-tolerance Disease-resistance
 Improved nutritional value

Others (Please specify): _____

6. Which of the following have you taken part in?

| | 0 | 1 – 3 | 4 - 6 | 7 – 9 | 10+ |
|---|---|-------|-------|-------|-----|
| Acquiring patents for your innovations | | | | | |
| Acquiring rights to a product, technology, or intellectual property from another organization or researcher | | | | | |
| Selling rights to a product, technology, or intellectual property to another organization or researcher | | | | | |
| Formed a separate firm to pursue the commercialization of a successful innovation(s) | | | | | |

| | | | | | |
|--|--|--|--|--|--|
| It is important to put agricultural innovations into the market | | | | | |
| I only engage in R&D activities that will have a return on investment | | | | | |
| I am passionate about bringing innovations into the market | | | | | |
| The organization/institution encourages me to put my R&D outputs into the market | | | | | |
| I am motivated by other scientists who have put their innovations in the market | | | | | |
| I dedicate a lot of time to marketing Agri-biotech innovations | | | | | |
| I remain disciplined when pursuing new opportunities | | | | | |

SECTION D – ENTREPRENEURIAL CULTURE

Please tick as appropriate the statements that best describe your organization.

1 – Strongly Agree 2 – Agree 3 – Somehow 4 – Disagree 5 – Strongly Disagree

| | 1 | 2 | 3 | 4 | 5 |
|--|---|---|---|---|---|
| Encourages creativity | | | | | |
| Encourages taking risks to pursue innovations with huge investments and huge potential returns | | | | | |
| Prioritizes R&D activities with commercial potential | | | | | |
| Is clear about its support for researchers in Agri-biotech crop innovations throughout the whole process | | | | | |

| | | | | | |
|--|--|--|--|--|--|
| Focus on creating value for the public | | | | | |
| Seeks to outdo and stay ahead of other firms engaged in Agri-biotech crop R&D | | | | | |
| Focused on developing products that are substantially different from existing products in the market | | | | | |
| Has adopted policies that promote commercialization | | | | | |
| Includes commercialization in the R&D process | | | | | |

SECTION E – STRATEGIC ENTREPRENEURIAL LEADERSHIP

Tick as appropriate the statements that apply to your organization.

1 – Strongly Agree 2 – Agree 3 – Somehow 4 – Disagree 5 – Strongly Disagree

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| The organization provides leadership in the commercialization of Agri-biotechnology innovations | | | | | |
| I have role models who encourage me to pursue my innovations | | | | | |
| The organization has a technology transfer office to assist researchers | | | | | |
| The organization offers training on R&D to researchers | | | | | |
| My position in the organizations makes it easy to pursue my crop innovations to the end | | | | | |

SECTION F – STRATEGIC RESOURCE MANAGEMENT

Please tick as appropriate the statements that apply to you.

1 – Strongly Agree 2 – Agree 3 – Somehow 4 – Disagree 5 – Strongly Disagree

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Predominantly use existing organization resources | | | | | |
| Consider the potential of an innovation before undertaking it | | | | | |
| Consider my technical capacity before deciding to pursue an R&D innovation | | | | | |
| Involve non-scientist professionals in their domains throughout all steps of R&D | | | | | |
| Actively seek partnership and collaboration with other firms in the R&D of innovations. | | | | | |
| Endeavors to keep my R&D activities confidential | | | | | |
| Have access to knowledge resources from my organization to pursue R&D activities | | | | | |
| A part of networks that support Agri-biotechnology innovations | | | | | |

APPENDIX II: GRADUATE SCHOOL LETTER OF APPROVAL



KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke

Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 810901 Ext. 4150

Internal Memo

FROM: Executive Dean, Graduate School

DATE: 27th August, 2024

TO: Odhiambo Antony Benard Kodiwo
C/o Business Administration Dept.

REF: D53/OL/HEP/20295/2022

SUBJECT: APPROVAL OF RESEARCH PROJECT PROPOSAL

This is to inform you that Graduate School Board at its meeting of 14th August, 2024 approved your Research Project Proposal for the M.B.A Degree Entitled, "Strategic Entrepreneurship and Commercialization among Organizations Involved in Agri-Biotechnology Crop Innovations in Nairobi City County, Kenya."

You may now proceed with your Data Collection, Subject to Clearance with Director General, National Commission for Science, Technology and Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed Supervision Tracking and progress report Forms per semester. The Forms are available at the University's Website under Graduate School webpage downloads.

Also, please ensure that you publish article(s) from your project before submitting it to Graduate School for examination as per the Commission for University Education and Kenyatta University guidelines.

Thank you.

ANNBELL MWANIKI

FOR: EXECUTIVE DEAN, GRADUATE SCHOOL

c.c. Chairman, Business Administration.


Supervisors:


1. Dr. Stephen Muathe
C/o Department of Business Administration
Kenyatta University

AM/mo




APPENDIX III: RESEARCH PERMIT


REPUBLIC OF KENYA


NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

Ref No: 287821
Date of Issue: 28/September/2024

RESEARCH LICENSE





This is to Certify that Dr. Benard Antony Odhiambo of Kenyatta University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: STRATEGIC ENTREPRENEURSHIP AND COMMERCIALIZATION AMONG ORGANIZATIONS INVOLVED IN AGRIBIOTECHNOLOGY CROP INNOVATIONS IN NAIROBI CITY COUNTY, KENYA for the period ending : 28/September/2025.

License No: NACOSTI/P/24/40265

287821

Applicant Identification Number


Director General
NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

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