



ENTREPRENEURIAL MICROBIOLOGY: A PERSPECTIVE OF MICROBIOLOGY FOR WEALTH CREATION

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ABSTRACT: *This research paper frantically inquired to ascertain the entrepreneurial potential of Microbiology for wealth creation and poverty reduction. This study adopted a qualitative research methodology through the extant and systematic, exploratory review of literature to carry out this study which is modified to understand the motivations, viewpoints, theories and views of scholars in order to address the study issue. This study relied on a secondary source of data. This study revealed that there are many chances for innovation and expansion when microbiology is pursued as a business or entrepreneurship. Infectious illnesses, food safety, environmental pollution, and renewable energy are some of the most urgent issues confronting society today. The paper found that the worldwide market for microbial goods, estimated at USD 160 billion in 2022, grew at a compound annual growth rate (CAGR) of 6% between 2023 and 2033. The sector is expected to grow to be worth USD 286.53 billion by 2033. Entrepreneurs in this industry are creating new goods and technology to solve these issues. The study discovered that entrepreneurial microbiology has the potential to have a big social and economic effect on the globe with the correct funding and assistance. The study concluded that entrepreneurial microbiology has the potential for wealth creation through the increase in demands for microbial goods and biotechnology. The study recommended a more robust top-level Microbiology and biotechnology design and implementation within the entrepreneurial ecosystem for wealth creation and poverty reduction, as well as economic development of Nigeria. Microbiologists should develop entrepreneurial mindset and culture in opportunity identification and economic exploitation of such business opportunities for self-sufficiency and self-actualization.*

KEYWORDS: Entrepreneurship, Microbiology, Entrepreneurial microbiology, Wealth creation, Biotechnology.



INTRODUCTION

The scientific study of microorganisms, including bacteria, viruses, fungus, and parasites, is known as microbiology. It has developed into a sector with enormous entrepreneurship potential in recent years. The subject of microbiology has expanded business potential due to technological advancements and consumer desire for safe products devoid of hazardous bacteria. “Medical microbiology, microbiologists are able to identify, isolate, diagnose, and prevent pathogenic microorganisms because of their routine training in microbiology” (IQBAL, 2023: 1). Microorganisms have a big influence on the environment, wildlife, food supply, and medical field (BYJUS, 2022). They are used in many fields, including as healthcare, veterinary, food, and pharmaceutical microbiology. Microorganisms are important for the environment, the financial system, and human health. Depending on the particular requirements of microbial scientists, the uses of microorganisms might be advantageous or harmful (BYJUS, 2022).

Entrepreneurs on the other hand, are recognized for their ability to generate fresh concepts, expand the economy, generate revenue, transform the economy, and apply their diverse skill set in wealth creation (Chukwuka & Igweh, 2024). Entrepreneurs are multitasking people who use their skills, generate new ideas, grow the economy, and make money. The process of taking advantage of opportunities and bringing together all the components, people included, to transform an idea into a profitable business is known as entrepreneurship. The global economy greatly benefits from the efforts of entrepreneurs, as small and medium-sized enterprises (SMEs) account for 55% of GDP in developed nations. SMEs account for 90% of all businesses globally and employ half of the labor force (Kansas, 2001). Science's field of microbiology is concerned with the investigation of microbes, including parasites, fungus, viruses, bacteria, and slime molds.

Microbiology is essential to entrepreneurship since it helps entrepreneurs come up with novel ideas and solutions for a variety of problems. Microbial biotechnology, in particular, presents opportunities for the creation of innovative consumer goods and services. In this sense, using microorganisms to produce biofuels might help reduce dependency on fossil fuels and stop global warming. Microbial biotechnology may be used to produce enzymes, various biologics, antibiotics, and more. Furthermore, microbiology has enabled the development of probiotics and prebiotics as well as other advancements in the management of food safety and quality. Because of this, microbiologists with an entrepreneurial mindset may tackle both national and fundamental issues, as well as financial difficulties like unemployment. Some of the traits of entrepreneurs include the use of their skills, technological innovation, economic growth, economic success, and economic transformation (Amaesan et al., 2022). Science is a field that is always expanding and changing for applications in business, the house, and the environment. Given the field's rising popularity in these fresh fields, a different viewpoint is required to integrate these revolutionary aspects of microbiology and provide economic stability (Amaesan et al., 2022).

Microbiology provides entrepreneurs with several benefits, including promoting innovation, meeting growing market needs, enhancing sustainability, providing a broad variety of applications, cutting costs, and enabling speedy development. Entrepreneurs may leverage microbial biotechnology to create novel goods and services, such medications and treatments, that fill market gaps for a range of industries, including agriculture, healthcare, and environmental management. The growing market for microbiological products, which is



projected to reach USD 286.53 billion by 2033, offers significant economic prospects. By supporting the use of renewable resources and tackling environmental problems, microbiology also supports sustainable behaviors. Microbiological technologies are both economically viable and rapidly developing, which encourages entrepreneurs to come up with creative solutions that are as efficient as possible (Iqbal, 2023; Timmis et al., 2017; Dunlap, 2001).

Sustainable development's economic growth is contingent upon curbing the alarming rate of population expansion, especially in developing countries, by enacting improved public health policies that reduce infant mortality and increase life expectancy. This leads to a demographic dividend, whereby a larger share of the population engaged in the economy raises potential revenue; policies that support health and education, regulate capital markets, and provide skilled employment opportunities are necessary to build on this. Development's economic growth is dependent upon the bio-based economy, particularly biotechnology, which stimulates innovation and attracts substantial investment from potential clients. Biotechnology is essential for experienced economic development because it may solve global issues, increase productivity, and provide skilled jobs (Timmis et al., 2017).

LITERATURE REVIEW

The New Concept of Entrepreneurial Microbiology

Entrepreneurial Microbiology is a vast field of study which involves the commercialization and discovery of living things, plants, foods, and biological resources as they are explored in microbiology to ascertain any possible benefits to human health through the integration of entrepreneurship (Chukwuka, 2023). Microbiologists have the ability to tackle economic problems including job shortages, fundamental changes, and national improvements. The lack of resources, facilities, and knowledge in the field of DNA recombinant technology stifles creative thinking and slows down the country's economic development. This is one of the contributing causes to entrepreneurs' reluctance to take initiative and implement improvements. This suggests that in order to stop the rising unemployment rate in our society, we need to teach people how to be innovators. This will help the economy expand. Microbiology is essential to entrepreneurship since it helps entrepreneurs come up with novel ideas and solutions for a variety of problems. Microbial biotechnology, in particular, presents opportunities for the creation of innovative consumer goods and services. In this sense, using microorganisms to produce biofuels might help reduce dependency on fossil fuels and stop global warming

Microbiology is a broad science that explores the potential benefits of studying, discovering, and commercializing living creatures, foods, plants, and biological resources for human use. Microbiologists now have the opportunity to contribute to the resolution of economic issues such as joblessness, structural adjustments, and national advancements. Innovative research and the nation's economic growth are slowed down by the absence of recombinant DNA technology facilities, resources, and technical expertise. This is among the causes of the inability of entrepreneurs to advance and create changes (Chukwuka, 2024). This has demonstrated that we must teach individuals how to be entrepreneurs if we are to prevent the unemployment rate in our society from rising. This will support economic expansion. Natural intellectual resources and endowments abound in our nation, which have the potential to boost the economy and lessen the present rate of brain drain. Being an entrepreneur is having the



ability to see opportunities for change and take action on them. An increasingly popular and relatively new career choice among scientists is becoming an entrepreneur. It was almost a given ten or so years ago that someone with a Ph.D. would end up as a professor. However, PhDs are in high demand these days, and a Ph.D. with a good concept may turn a burgeoning firm around very fast.

The Benefits of Microbiology as an Entrepreneurship

Microbiology provides enterprises with a number of advantages, such as:

Innovation potential: The wide range of applications offered by microbiology can encourage business owners to create cutting-edge goods and services. For example, the employment of microbes in biotechnology can result in the creation of novel medications and treatments that meet unmet medical requirements which sustain public health and also create wealth for the scientist through entrepreneurship (Chukwuka & Imide, 2024).

Growing market demand: As more people become aware of the advantages of microbial biotechnology, there is a greater need for microbial goods and services, which presents business owners with a sizable and developing market which have great potentials for wealth creation through entrepreneurship (Chukwuka, 2016).

Diverse applications: Microbiology is used in many different fields, including as environmental remediation, food, agriculture, and healthcare. These programs may be used by entrepreneurs to create goods and services that target various customers and sectors thereby making money and solving societal problems. Microbial diversity is the variety of distinct unicellular creature types, which includes bacteria, archaea, protists, and fungi. In the biosphere, a vast array of microorganisms coexist, defining boundaries between life and facilitating the survival and evolution of other living things. Microorganisms differ from one another due to their diverse ecological distributions, activities, and unique genomic structure, expression, and evolution. Additionally, they differ in morphology, physiology, and physiology/cellular metabolism. Although it is widely acknowledged that there are millions of bacteria on Earth today, the precise amount of microbial diversity is not well understood. Currently, a multitude of bacteria can be quickly investigated thanks to new molecular technological advancements (Dunlap, 2001).

Sustainability: Microbial biotechnology, one of the branches of microbiology, provides long-term answers to a number of problems, such as food security, climate change, and environmental degradation. Entrepreneurs that create goods and services to deal with these issues can profit from this by creating wealth through entrepreneurship. One area of microbiology that provides constant answers to several issues, including food security, climate change, and environmental degradation, is microbial biotechnology. This may help entrepreneurs who develop goods and services to address these kinds of issues. To reduce waste and greenhouse gas emissions, some strategies to do this include using renewable resources, turning garbage into items that are useful, and streamlining industrial processes (Iqbal, 2023). Microbes are fundamental to the functioning of planets and ecosystems due to their ubiquity throughout the biosphere and the diversity of their activities. They mediate and regulate biogeochemical cycles and the recycling of biological materials and waste, are important producers and sinks of greenhouse gasses and are therefore important determinants of climate



change. They also play crucial roles in soil fertility and structure, as well as the quality and productivity of land, seas, lakes, and rivers.

According to Timmis et al. (2017), microbes are consequently essential members of the committee of stewards of planetary health and sustainability.

Microbiology Applications for Entrepreneurship

Applications for microbial entrepreneurship include:

Bioremediation: Utilizing microorganisms to break down or purify environmental contaminants is known as bioremediation. Bioremediation has been a burgeoning area of microbiology as an entrepreneurial pursuit due to growing concerns about environmental sustainability and pollution. It is possible for entrepreneurs to create goods and services that employ microbes to purify polluted air, water, and soil. Bioremediation is the process of using microorganisms to break down or detoxify pollutants in the environment. Bioremediation has emerged as a potentially fascinating field of microbiology as concerns about cleanliness and sustainable development have increased. Entrepreneurs may use the bacteria to create products and offers that purify tainted soil, water, and air (Ayesha & Saira, 2023). The broad concept of bioremediation captures the several degrees of multiscale complexity involved in removing hazardous waste from damaged sites. A growing quantity of omics data on a wide variety of environmental microorganisms and modeling of their individual and integrated biological activities are available to guide interventions for enhancing the performance of desired biodegradation processes. The question at hand is whether the new understandings brought about by synthetic biology and systems biology can lead to the development of more powerful biological agents that can clean up with remarkable efficiency and acceptable hazards. Metabolism is the main, but not exclusive, component of bioremediation. Many activities that take place upstream—such as bioavailability, weathering, and abiotic catalysis of contaminants—as well as downstream—such as stress, predation, and competition of the very biocatalysis—limit the outcome of the overall activity (Lorenzo, 2011).

Synthetic biology: The engineering of biological systems to produce novel products or functionalities is known as synthetic biology. Entrepreneurs may use created microbes to create unique goods and services thanks to advances in genetic engineering and gene editing technology. Creating novel vaccinations, biofuels, and biomaterials are a few examples of this. Synthetic biology is the scientific modification of biological structures to create new products or facilities (Ayesha & Saira, 2023). New advances in genetic engineering and gene modification technology allow entrepreneurs to create unique products and services using well-established bacteria. Creating novel vaccines using biofuels and biomaterials is one example of this (Iqbal, 2023). Synthetic biology makes use of genetic engineering, a quickly developing field that entails changing an organism's genetic makeup to make it express particular proteins. Proteins make up the “machinery” that powers the production and modification of substances within cells. Because genes are so complex, enabling these pathways to operate requires a great deal of trial and error (Futurum, 2023).

Personalized medicine: Utilizing specific patient information to customize medical interventions is known as personalized medicine. Microbiology is essential to personalized medicine, and the investigation of the microbiome is becoming more and more significant for



the diagnosis and management of disease. Entrepreneurs may create goods and services that use microbiome data analysis to offer individualized medical treatment.

Microbial fermentation: The process of using microorganisms to transform organic substrates into valuable products is known as microbial fermentation. Entrepreneurs may use microbial fermentation to create new goods and services thanks to developments in fermentation technology. This can involve creating novel food and drink items, probiotics, and compounds derived from biotechnology.

Microbial testing and diagnostics: In many different businesses, regulatory compliance, safety, and quality control all depend on microbiological testing and diagnostics. Entrepreneurs can create new goods and services that offer microbiological testing and diagnoses that are quicker and more accurate thanks to developments in rapid diagnostic technology.

Agricultural biotechnology: The application of microorganisms in agricultural biotechnology aims to increase plant development and crop production. A crucial area of microbiological entrepreneurship, agricultural biotechnology is growing in importance as worries about food security and sustainability rise. Microorganisms may be used by entrepreneurs to create goods and services that improve soil health, protect crops from pests and illnesses, and promote plant development.

Food: Fermented foods like yogurt, cheese, and sourdough bread may be produced with the aid of microbial engineering. Additionally, the manufacturing of food additives and flavorings, food safety, and food preservation all employ microbes.

Advantages of Microbiology in Entrepreneurship

Microbial biotechnology offers advantages to entrepreneurs in a number of ways, such as: **Cost-effectiveness:** The creation of biologics and the cleaning up of contaminated surroundings are just two problems that can be solved economically by specialists in microbiology domains like microbial biotechnology. Microbial biotechnology and other microbiology-related sectors can offer reasonably priced solutions for a number of problems, including the manufacture of biologics and the cleaning up of contaminated areas (Iqbal, 2023). With the exception of a few favorable ones, the bulk of microorganisms are found naturally and are simple to employ. They gain from creating such affordable, ecologically beneficial goods and services.

Versatility: It may be used in a wide range of industries, such as environmental remediation, food, agriculture, and healthcare. This adaptability offers business owners a multitude of chances to create cutting-edge goods and services.

Sustainability: It provides long-term answers to a range of problems, such as environmental deterioration, food security, and climate change. Entrepreneurs that create goods and services to deal with these issues can profit from this. One area of microbiology that provides constant answers to several issues, including food security, climate change, and environmental degradation, is microbial biotechnology. This may help entrepreneurs who develop goods and services to address these kinds of issues. To reduce waste and greenhouse gas emissions, some strategies to do this include using renewable resources, turning garbage into items that are useful, and streamlining industrial processes (Iqbal, 2023). Microbes are essential components of the operation of planets and ecosystems due to their widespread presence throughout the



biosphere and the variety of their activities. According to Timmis et al. (2017), microbes are consequently essential members of the committee of stewards of planetary health and sustainability.

Rapid development: The capacity of microorganisms to multiply quickly plus the accessibility of genetic engineering techniques can result in the rapid production of new goods and services. Because genetic engineering tools are readily available and microorganisms multiply fast, this can result in the rapid development of new goods and services (Iqbal, 2023). Humans have always benefited from microorganisms, but as technology advances and our understanding of microbes grows, microbes are evolving quickly. Microbes are being effectively utilized by scientists and businesses.

Challenges of Microbiology in Entrepreneurship

Microbiology entrepreneurs encounter a number of difficulties, such as:

Intellectual property: Due to the participation of several parties and the possibility of legal conflicts, the ownership and protection of intellectual property rights can be complicated.

Regulatory compliance: There are stringent regulations that apply to microbial goods and services. To get their items onto the market, entrepreneurs have to navigate a maze of rules and secure the appropriate permissions.

Risk management: The environment and human health may be at danger from microbiological goods and services. Entrepreneurs need to evaluate the risks and implement suitable safety measures and risk assessments to handle them.

Competition in the market: New startups and well-established businesses are vying for market share in the highly competitive microbiological sector. In order to stand out, entrepreneurs need to create distinctive goods and services that have a clear market need.

Quality control: The efficacy of microbiological testing services depends on their precision and dependability. Entrepreneurs need to make sure that their testing protocols adhere to legal and industry norms.

Facilities and equipment: Acquiring and maintaining specialist facilities and equipment is necessary for providing microbial testing services, and this can be costly. To offer dependable and effective testing services, entrepreneurs need to invest in these resources.

RESEARCH METHODOLOGY

This study adopted a qualitative research methodology through the extant and systematic, exploratory review of literature to carry out this study which is modified to understand the motivations, viewpoints, theories and views of scholars in order to address the study issue. This study relied on a secondary source of data.

Guillaume (2019) asserts that systematic literature reviews are a method for synthesizing scientific data to address a specific research issue in a transparent and replicable manner, while attempting to incorporate all available data on the subject and evaluating the quality of this



data. Additionally, Mengist et al. (2020) note that systematic literature reviews aid in mapping out existing knowledge and identifying knowledge gaps on particular topics. This paper developed a systematic review of literature to analyze the main academic contribution to the related topic of Entrepreneurial potentials of Microbiology and its related theories.

Thematic analysis served as the foundation for the literature analysis research methodology. "Thematic analysis is the process of identifying patterns or themes within qualitative data," state Braun and Clarke (2015: 225). The first step in the analysis of the data on competitive intelligence processes was to familiarize oneself with the data. This involved reading the abstracts of all the articles and skimming the content, paying close attention to the Entrepreneurial Microbiology cycle and its associated phases. This phase, according to Charmaz (2015), enables you to jot down ideas and take notes.

RESULTS AND DISCUSSION

The study found that Entrepreneurial Microbiology has the potential for wealth creation through the increase in demands for microbial goods and biotechnology. Science and business are combined via the use of microbes as instruments in microbial entrepreneurship, which addresses social demands and spurs economic progress. This area of study combines creativity with microbiology to provide a multitude of applications, such as synthetic biology, agricultural biotechnology, and bioremediation. The market for microbiological goods is predicted to grow to a value of USD 286.53 billion by 2033, demonstrating its huge potential (Iqbal, 2023). Food security and environmental issues may be economically and sustainably resolved by entrepreneurs. Despite challenges including intellectual property rights, legal compliance, and the need for specialized equipment, microbial entrepreneurship offers enormous social and economic potential, making it an important area for more investigation. As more people become aware of the benefits of microbial biotechnology, the demand for microbial goods and services rises, allowing business owners to enter a massive market. The worldwide market for microbial goods, estimated at USD 160 billion in 2022, grew at a compound annual growth rate (CAGR) of 6% between 2023 and 2033. The sector is expected to grow to be worth USD 286.53 billion by 2033 (Iqbal, 2023). In the modern market, digital promotion is an important kind of advertising. This includes email marketing, social media advertising, search engine optimization, and further consumer-facing internet tactics. Obtaining and keeping clients will be crucial to the sustained expansion and success of the startup.

CONCLUSION

This study discovered that more people have become aware of the benefits of microbial biotechnology; the demand for microbial goods and services has risen, allowing business owners to enter a massive market. The paper revealed that the worldwide market for microbial goods, estimated at USD 160 billion in 2022, grew at a compound annual growth rate (CAGR) of 6% between 2023 and 2033. The sector is expected to grow to be worth USD 286.53 billion by 2033 (Iqbal, 2023). In the modern market, digital promotion is an important kind of advertising. There are many chances for innovation and expansion when microbiology is pursued as a business or an entrepreneurship. Infectious illnesses, food safety, environmental



pollution, and renewable energy are some of the most urgent issues confronting society today. Entrepreneurs in this industry are creating new goods and technology to solve these issues. Microbiology entrepreneurship has the potential to have a big social and economic effect on the globe with the correct funding and assistance. The study concludes that Entrepreneurial Microbiology has the potential for wealth creation through the increase in demands for microbial goods and biotechnology.

RECOMMENDATION

Based on the study findings, the paper recommends a more robust top-level Microbiology and biotechnology design and implementation within the entrepreneurial ecosystem for wealth creation and poverty reduction, as well as economic development of Nigeria. Microbiologists should develop entrepreneurial mindset and culture in opportunity identification and economic exploitation of such business opportunities for self-sufficiency and self-actualization.

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