TRADITIONAL KNOWLEDGE, BIOTECHNOLOGY INVENTIONS AND PROTECTION OF PLANT VARIETIES: EXPLORING THE CONCEPTS AND CONTRIBUTIONS TO NIGERIA'S ECONOMIC DEVELOPMENT

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Abstract

Plants are the basis of life on earth and the ability of humankind to exploit genetic resources to his advantage has indeed made human species the most successful organism. Traditional Knowledge developed through the utilization and management of natural resources have become invaluable for developing new kinds of food, cosmetics, drugs, and other products of industrial importance. while advancements in biotechnology and molecular genetics, have opened new vistas to exploit the plant genetic resources in our communities. Aside from ensuring sustainable use of resources to meet future demands for food and medicine, the potential economic value of traditional knowledge and biotechnological inventions in the form of genetically modified materials are increasing rapidly and stimulating international trade. Intellectual property protection has overtime become a key element of success and creating competitive advantage in the knowledge driven world of today and deemed crucial to plant breeding and access to seeds. Although it raises questions as to how commercial interests of intellectual property can be used to ascribe value to knowledge of nature without harming the traditional lifestyle that sustains. Utilizing traditional knowledge and plant genetic resources as a basis for biotechnological inventions reveals moral, economic, and social justifications for seeking its protection. The objective of this study is to analyze the concepts of Traditional Knowledge and Biotechnology inventions in the context of plant genetic resources and highlight the potential contribution of protecting plant genetic resources to the Nigerian economy. Doctrinal research methodology was adopted, relying on primary and secondary data. It was found that international and national attempts at protecting plant varieties show efforts at enabling laws that are suited for countries' realities and future aspirations. So, in a

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country like Nigeria, protecting plant breeders' rights should also guarantee the rights of local farmers in inventing plant varieties in order to enjoy its potential contributions to the economy.

Keywords: Traditional Knowledge, Biotechnology Inventions, Protection, Plant Variety, Nigeria

Introduction

Traditional Knowledge is rooted in indigenous communities, and it is a vital part of their wellbeing and sustainable development.[1] From time immemorial, Traditional Knowledge has been significant in the management of biodiversity and the ecosystem, with activities and practices developed by exploring, adapting, and experimenting that catered for generations.[2] Indigenous communities have continuously used biological resources as a source of sustenance and whether as a source of healthcare or for food, plant genetic resources harbor immense genetic potential.[3] Beyond its cultural value, biotechnology has had great influence in plant utilization.[4] Selective gene transfer, hybrid seeds and plants, nitrogen-fixing microorganisms, and new plant varieties with short life cycle etc have emerged with biotechnology, which has since paved the way for possibilities and greater economic and social significance.[5]

Like any resource of value, plant genetic resources clearly need to be protected.[6] It however seems necessary to exercise caution in extending intellectual property rights as a means of protecting inventions and traditional knowledge grounded in plant genetic resources. This is because unlike biotechnology inventions, traditional knowledge is not readily reconcilable with

[1] World Intellectual Property Organization, 'Traditional Knowledge and Intellectual Property- Background Brief.' WIPO Media Centre. Available at: www.wipo.int retrieves 4/2/2020

[2] A. M. Carvalho & A. Frazao-Moreira, "Importance of Local Knowledge in Plant Resources Management and Conservation in Two Protected Areas from Tras-os-Montes, Portugal." *Journal of Ethnobiology and Ethnomedicine, 2011 7:36, 2*. Available at: http://www.ethnobiomed.com/content7/1/36

[3] M. Davis, "Biodiversity and Indigenous Knowledge," Research Paper 17 1997-98. Available at <http://www.aph.gov.au>

[4] Lyndsey A. Withers, "Biotechnology and Plant Genetic Resources Conservation." Available at: http://www.bioversityinternational.org

[5] Ibid

[6] Ibid

existing intellectual property right systems.[7] Some have argued that it is not morally acceptable to commercialize or grant ownership rights on biological resources and intervene in the process of nature.[8] Although the advantages of biotechnology inventions have made significant impact in the field of pharmaceuticals and diagnostics for example, human insulin, erythropoietin, interferon, etc.[9] The contributions of the agricultural sector to the fulfillment of everyone's basic food and health needs is considered one of the reasons for discouraging individual appropriation of inventions in plant variety like the patent system hence, the development of a new form of protection outside existing intellectual property rights.

Traditionally, plant variety management excluded intellectual property rights[10] and in most cases, the local economy was based on farming with a high level of subsistence strategies such as mixed cropping, crop rotation, and land races used to minimize production risks.[11] The twentieth century however brought the development of significant private sector seeds industries, and calls for incentives to increase the presence of improved seeds in fields including the development of a form of legal protection for plant breeders.[12] This ushered in a *sui generis* model for the protection of inventions in plant varieties and breeders' rights which began internationally with the International Convention for the Protection of New Plant Varieties (UPOV) while the Trade Related Aspects of Intellectual Property Rights (TRIPs) Agreement strengthened the model.

Biotechnology and traditional knowledge in the context of plant genetic resources, have a lasting social, economic, ecological and cultural implication to communities and the world at large.[13] This immediately calls to mind the role of government in ensuring benefits from biotechnology, while strategies and policies must also be put in place to expose every aspect of biotechnology which might be harmful to traditional beliefs or enhance their capacities to

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[7] Freedom-Kai Philips, "Intellectual Property Rights in Traditional Knowledge: Enabler of Sustainable Development. *Utrecht Journal of International and European Law 1*, 5. Available at: http://dx.doii.org/10.5334/ujiel.283

[8] United Nations Conference on Trade and Development, "Key Issues in Biotechnology" (United Nations,2002) 12. UNCTAD/ITE/TEB/10)

[9] Ibid 8.

[10] Antons Christoph, "Sui Generis Protection for Plant Varieties and Traditional knowledge in Biodiversity and Agriculture". 102

[11] Carvalho & Frazao-Moreira, (n 2)

[12] J. Fernandez-Cornejo "The Seed Industry in the US Agriculture: An Exploration of data and Information on Crop Seed Markets, Regulation and Industry Structure, and Research and Development," Economic Research Service/USDA 2004, vi.

[13] Victoria Tauli-Corpuz, "Biotechnology and Indigenous People". Available at: www.twn.my retrieved, 12/1/22

sustainably conserve crops and associated knowledge.[14] Bearing in mind that Nigeria recently passed into law her plant varieties protection law,[15] It is expected that the legislation protects biotechnological advancements as well as traditional rights relating to plants' genetic resources in line with the country's realities and future aspirations.

To this end, this study explores the concept of traditional knowledge and biotechnology in relation to plant genetic resources; considers its protection and contributions to the Nigerian economy. To achieve this, the paper is divided into five parts. The first part analyzes the concept of traditional knowledge, biotechnology, and plant genetic resources. The second part examines plant use in biotechnological inventions and traditional knowledge. The third part discusses the protection of plant variety, the international regimes and the Plant Variety Act in Nigeria, while the fourth part seeks out the economic benefits and contributions of protection in Nigeria. The final part is the conclusion.

Traditional Knowledge

Traditional knowledge is described as the century old knowledge of indigenous communities or tribal communities who are the holders and preservers of such knowledge. According to WIPO,[16] It is knowledge, know-how, skills and practices that are developed, sustained and passed on from generation to generation within a community, and often forming part of its cultural or spiritual identity.[17] It will also mean the knowledge resulting from intellectual activity in a traditional context, and includes practices, and innovations. Traditional knowledge can be found in a wide variety of contexts, including cultural, agricultural, ecological and medicinal knowledge,[18] based on which systems have been developed by communities to conserve and utilize biological diversity.

Biotechnology Inventions

Biotechnology is generally used to connote technology that uses biological systems, living entities like animals, plants and microorganisms and their derivatives or causes changes in

[14] Ibid

[15] Plant Variety Protection Act, 2021

[16] World Intellectual Property Organization, "Summary on Traditional Knowledg*e".* Available at: https://www.wipo.int 14/2/2020

[17]Ibid

[18] Ibid

them.[19]According to the Organization of Economic Cooperation and Development (OECD) biotechnology is "the application of scientific and technological processes to living organisms, as well as parts, products and models thereof to alter living and non-living materials for the production of knowledge, goods and services". [20] In a broader sense, it combines the ideas and needs of biosciences with technology to produce new products from living organisms[21]with the goal of benefiting humanity. Biotechnology may be in form of medical biotechnology,[22]agricultural biotechnology, marine biotechnology and industrial processes for the development of new technologies all of which may or may not involve the transfer of genes.[23] Whether traditional or modern in terms of genetic resources, it encompasses well established techniques such as recombinant DNA technologies, monoclonal antibodies and tissue culture techniques.[24] Presently a variety of biotechnology techniques are used for conserving, evaluating and utilizing plant genetic resources. [25] Although there have been arguments for and against advancing biotechnological processes on grounds of ethical, environmental and economic considerations.[26]However, the global economic potential of biotechnology in offering benefits in vital sectors like food and healthcare have awakened discussions on finding solutions to the ethical and regulatory challenges.[27]

[19] Article 2 of the UN's Convention on Biological Diversity defined terms used in the convention including biotechnology in the context of achieving the objectives and purpose of the convention.; Camino Kavanagh, "Biotechnology : New Tech, New Threats and New Governance Challenges: An Opportunity to Craft Smarter Responses/, Carnegie Endowment for International Peace (2019), 23. Available at: <http://www.jstor.com/stable/resrep20978.6>

[20] B. V. Beuzekom & A. Arundel, "OECD Biotechnology Statistics- 2006", OECD, 2006, 7. Available at: www.oecd.org

[21] M. S. Azad & M. A. Hossan, "Agricultural Biotechnology for Green Revolution – Perceived Expectation and Potential Risks." *Journal of Food Technology 2 (1): 08-17, 2004*. Available at: www.researchgate.net retrieved 12/1/22

[22] Medical Biotechnology is also referred to as the Red Biotechnology which involves the use of organisms or genetic material to produce new medicine or replace damaged cells or tissues. see: Saurabh Bhatia, "History, Scope and development of Biotechnology." Chapter 1 Introduction to Pharmaceutical Biotechnology, Volume 1. IOP Publishing, 2018 1-61 available at: www.iopscience.iop.org 13/1/22

[23] Saurabh Bhatia, "History, Scope and Development of Biotechnology." Chapter 1 Introduction to Pharmaceutical Biotechnology, Volume 1. IOP Publishing, 2018 1-61 available at: www.iopscience.iop.org 13/1/22

[24] Ibid

[25] Pocket K No. 44, Biotechnology for biodiversity. Available at www.isaaa.org

[26] Canadian Biotechnology Advisory Committee, "Patenting of Higher Life Forms and Related Issues." Report to the Government of Canada

[27] Camino Kavanagh, 'Biotechnology: New Tech, New Threats, and New Governance Challenges: An Opportunity to Craft Smarter Responses', Carnegie Endowment for International Peace (2019), 23. Available at: <http://www.jstor.com/stable/resrep20978.6> 2/5/22

Traditional Knowledge and Use of Plants

Biological diversity encompasses all species of plants, animals and microorganisms, the variation between them, and the ecosystems of which they form a part.[28] Plants are species of biodiversity, which are used and applied by the indigenous communities.[29]Traditional knowledge associated with plants reveals that some are enriched with medicinal properties, and some are food plants. As a result of their long use, traditional knowledge reveals details of general use, plant parts, seasons and regions in which active species can be found.[30] Knowledge of effects of plants have also overtime become viable alternative pathways for drug discovery and bioactive compounds in plant genetic resources.[31] Some examples of novel compounds from the plants used by the ethnic communities discovered to be most clinically useful include 'Resperine' found in *Rauwolfia serpentina* used as a circulatory stimulant (antihypertensive), Morphine and Codeine both found in *papaver somniferum* and used as analgesics.[32]

Traditional Knowledge has also continued to play a critical role in food security and agricultural development, inventing local varieties from experience gained over the centuries and adapting to the environment.[33] Taking the form of community laws, and agricultural practices for example; adaptation strategies employed by indigenous farmers like as adjusting crop varieties and planting dates; relocating crop etc, play a vital role in the management of genetic resources,[34]and improving agricultural techniques. Traditional on-farm conservation of crops is a dynamic process, in which varieties managed by indigenous farmers continue to evolve in response to natural and human selections, leading to crops with better adaptive

[28]European Environment Agency, "Biological Diversity". Available at <http://biodiversity-chm.eea.europa.eu/nyglossary_terms/B/biological_diversity>. 12/2/22

[29] J. Turanika, J. Tamiselvi, "Traditional Knowledge and Patents Issues in India," *International Journal of Pure and Applied Mathematics 2018 Vo l.119 No. 7*. Accessed 11/2/2020 www.acadpubl.eu/hub/

[30] V. Mandal et al, 'An Inside to the Better Understanding Ethnobiological route to Drug Discovery- the need of the Hour.' Natural Product Communications 2012 Vol.7 No11 1551-1554, 1552. Available at <http://journals.sagepub.com> 20/2/22. See also J. W. Gruber, 'Back to the Future: Traditional Medicinals Revisited the Use of Plants in Medicine" Laboratory Medicine 1996 Vol.27 No. 2, 101. Available at: <https://academic.oup.com/labmed/article-absract/27/2/100/2503456> retrieved 18/2/22.

[31]Ibid

[32] J. W. Gruber, 'Back to the Future: Traditional Medicinals Revisited the Use of Plants in Medicine' Laboratory Medicine 1996 Vol.27 No. 2, 101. Available at:<https://academic.oup.com/labmed/article-absract/27/2/100/2503456> retrieved 18/2/22.

[33] N.O. Adedipe Et al, 'The Relevance of Local and Indigenous Knowledge for Nigerian Agriculture', Presented at the International Conference on Bridging Scales and Epistemologies: linking Local Knowledge with Global Science in Multiscale Assessment, March 16-19, 2004, Alexandria Egypt.

[34] *Ibid*

potential.[35] This became important when in some parts of the world the introduction of new plant varieties meant the disappearance of the local varieties.[36] Others, especially the developing countries who did not have a means to undertake the process of innovation nor its social and environmental consequences, continued to promote the collection and conservation of local varieties.[37]

Protecting Traditional Knowledge

The idea of protection and the question of what regulations are available to protect traditional knowledge have become fundamental issues in the 21st century.[38] The realization that traditional knowledge can also be utilized in combination with modern science and technology to address current problems further reinforces it as a valuable source of knowledge.[39] Intellectual property rights and its contemporary application have extended to biological resources and have direct impact in its use for recognizing and controlling traditional knowledge.[40] Arising from agitations of indigenous communities and concerns for sustainable use, traditional knowledge on plant genetic resources can be protected while recognizing the stewardship of farmers who maintain the knowledge and resources.[41]

The modern intellectual property rights framework has been condemned in its present available structure for not just neglecting to give satisfactory protection to traditional knowledge but for legitimizing its misappropriation.[42] The key issues in protecting traditional knowledge have been identified as prior knowledge of the innovation, and the fact that traditional knowledge is a collective belonging of the community which a single individual cannot claim a right over.[43] A lot of traditional knowledge is already in public domain being passed on orally, and mostly undocumented through generations, this makes most of it ineligible for intellectual property

[35] Frederic Thomas, "Biodiversity, Biotechnology and Traditional Knowledge: from the Common Heritage of Mankind to Access to Genetic Resources and Benefit-sharing (ABS)", *Revue Tiers Monde 2006 Vol. 188 Issue 4, 825-842*. Available at: www.cairn-int.info retrieved 11/1/22

[36] Ibid

[37] Ibid

[38] S. K. Chakraborty, "Protection of Traditional Knowledge and Plant Intellectual Property Rights: Emerging Challenges and Issues in India". *Amity International Journal of Juridical Sciences' 2017 Vol.3*, 3. Available at: http://amity.edu 10/1/22

[39] Adedipe et al, n33.

[40] Chakrabarty n38.

[41] Charles R. McManis, "Biodiversity, Biotechnology, and the Legal Protection of Traditional Knowledge," 2005, 17 WASH. U. J. L. & POL'Y 1. Available at: https://openscholarship.wustl.edu/law_journal_law_policy/vol17/iss1/ 14/2/2020

[42] Turanika & Tamiselvi n 27.

[43] Ibid

protection as it is already part of "prior art". In other words, there is very little in terms of novelty that can be established for protection.

In recent times, aside from customary laws,[44] defensive and positive approaches have been developed for the protection of traditional knowledge.[45] The defensive protection refers to a set of strategies to ensure that third parties do not gain illegal or unfounded intellectual property rights over traditional knowledge, as was in the Tumeric case.[46] Other defensive measures include collecting elements of traditional knowledge in a database to allow their retrieval by patents and trademark examiners in consideration of prior art or otherwise as bars to their registration.[47] The requirement that patent applicants disclose the origin of genetic resources and evidence of prior informed consent of the traditional knowledge holders where such genetic resources are utilized is also a defensive mechanism that is adopted.[48]The "positive" approach to the protection of traditional knowledge, are in form laws enabling traditional knowledge holders assert exclusive property rights on their knowledge and resources.[49] In adopting these approaches, governments have either utilized existing mechanisms of intellectual property and others have preferred to establish sui generis legal regimes adapted to the special characteristics of Traditional knowledge.

Historical Background of Biotechnology for Plant Genetic Resources

[44] B. Sodipo, 'Overview of Intellectual Property Rights Protection for Traditional Knowledge, Innovation and Traditional Medicine Practice in Nigeria.' in Book of Proceedings International Workshop on Intellectual Property Rights (IPRs) for Traditional Medicine and Practice, NOTAP 2005. 68.

[45] Suchi Rai, "India: Traditional Knowledge and Scope for Patent Protection". Available at:www.mondaq.com 15/2/2020

[46] The US Patents Office revoked patents granted on turmeric (use of turmeric in wound healing) when it was revealed that the claims made on the patents were drawn from the traditional knowledge base of the developing countries. US Patent was awarded to Medical Centre of University of Mississippi for the use of wound healing property of turmeric. Dr. R.A.Mashelkar who was the Director of Council of Scientific and Industrial research (CSIR) in India opposed the patent granted to the Medical Centre of Mississippi University and worked hard for awakening India"s traditional knowledge of Turmeric. The claim was supported by documentary evidence which was an old newspaper dated 1953 printed and published by Indian Medical Association, and there was also evidence produced which includes old and ancient texts in Sanskrit. In 1998 April, the judgement favoured CSIR which was based on the argument that was proved with strong documentary evidence that Turmeric was being in use by Indian people since ancient period of time.
See S. Balasubramanian, "India: Traditional Knowledge and Patent Issues: an overview of Turmeric, Basmati, Neem Cases. Available at www.mondaq.com retrieved 4/2/2020

[47] Mccain's n41.

[48] Ibid

[49] Ibid -

Biotechnology evolved through historical events that can be broadly described into ancient, classical, and modern biotechnology.[50] Ancient biotechnology is traced to pre-1800 during which more traditional forms of biotechnology were practiced. Early history revealed domestication and selection of quality species of plants and animal cross breeding. Later built upon by the use of fermentation processes for the production of food and drugs.[51] The classical period (1800 to mid-20th century) for biotechnology ushered in significant advances in techniques and understanding including[52]; Friedrich Miescher's discovery that the basic constituents of cell nucleus were nucleoproteins[53], Mendel's mechanism for heredity, and the birth of human genetics.[54] The collaboration between the Rockfeller foundation and the Mexican Government which led to plant breeding globally were also developed during this time. Modern biotechnology emerged after the second world war when researchers applied and made discoveries that had unlimited implications such as the advent of genetic engineering and the human genome project.[55]Biotechnology has since continued to look ahead to help humanity although we must ensure that its destructive tendencies are checked.

It is worthy of note that the Green Revolution[56]is attributed to biotechnology. It derives from the desire to increase crop yield, produce virus free genetic stock and planting materials to meet the increasing population demand for food in the world.[57] The scope of biotechnology in relation to plants is very wide and the advantages cut across reducing time, cost, and environmental challenges. The economic and production impact of adopting genetically

[50]Saurabh Bhatia, History, Scope and Development of Biotechnology; Introduction to Pharmaceutical Biotechnology, 2018 Volume 1 Basic Techniques and Concepts. IOP Publishing Ltd 1-61. Available at: www.iopscience.iop.org retrieved 11/1/22

[51] Ibid

[52] Ibid

[53] Nucleoproteins are combinations of basic proteins and nucleic acid, which were later established as Deoxyribonucleic acid (DNA).

[54] Gruber n 31 1-11

[55] Ibid 1-25

[56] The Green Revolution was coined in the late 1960s when Agricultural Biotechnology struck a breakthrough and the International Rice Research Institute (IRRI) (founded by the Rockefeller Foundation and the Ford Foundation working with the Mexican Government developed what was referred to as the miracle seed. the first high yielding rice variety with pest control and fertilizers. The revolution quickly developed and spread to Asia among other developing countries. The Green Revolution contributed to the widespread reduction of poverty, hunger and reduced land use for agriculture while raising the income of farmers. see, International Rice Research Institute, "Breakthrough in Improving Yield Potential Could Continue What the Green Revolution Started". Available at <http://www.irri.org> retrieved 12/1/22.

[57] International Rice Research Institute, "Breakthrough in Improving Yield Potential Could Continue What the Green Revolution Started". Available at <http://www.irri.org> retrieved 12/1/22.

modified crops at the global level in 2017 and 2018 according to Brookes[58] includes higher farm income from reduced cost of production and increase in volume. With a 5.8% increase to the global production of maize, soyabeans and cotton at a total income of 88%.[59]Improving nutritional value of food is also one of the many possibilities of biotechnological inventions and this is achieved by enhancing the presence of special nutrients or chemical in plants.[60] Although the most reasonable conclusion is that technologies will continue to provide yield increase, environmentalists have cautioned that genetic engineering and biotechnology inventions should be proceeded with care as there are inherent risks associated with it.[61]

Patenting Biotechnological Inventions in Genetic Resources

The moral arguments attached to commodification of life have been raised in considering patenting inventions in genetic materials, raising further questions of whether the legal protection (patent) of life forms violates any inherent value of life.[62] Environmental reasons such as preservation of biodiversity and the rights of indigenous people and economic considerations of creating exclusive monopoly over naturally occurring materials have also been put forth. The restriction on patenting products of nature evolved from the common law rules which established the doctrine without any details of its scope in the form of legislative guidance.[63] Generally, new, useful and works that are capable of industrial application are protected as inventions mostly under patent.[64] So in Nigeria based on this common law doctrine, the Patent Act explicitly limited patentable subject matters and declared plant and animal varieties non patentable.[65] As a result, naturally occurring substances, microorganisms

[58] Brookes Graham & Peter Barfoot, "GM Crop Technology Use 1996-2018: Farm income and Production Impacts." *GM Crops & Food 2020, Volume 11, 202 No. 4, 242-261*. Available at: <https://doi.org/10.1080/21645697.2020.1779574>

[59] Ibid

[60] Ibid

[61] David Pimentel, "Genetically Modified Crops and the Agroecosystem: Comments on "Genetically Modified Crops; Risks and Promise by Gordon Conway' *Conservation Ecology, 2000 Vol 4, No.1* . Resilience Alliance Inc. 2. Available at: <http://www.jstor.org/stable/26271741>

[62] Canadian Biotechnology Advisory Committee, 'Patenting Higher Life Forms and Related Issues'. Report to the Government of Canada Biotechnology Ministerial Coordinating Committee: 2002, C2-598/ 2001-2. Available at :<www.publications.gc.ca> .

[63] Samantak Ghosh, "Gene Patents: Balancing the Myriad Issues Concerning the Patenting of Natural Products". *Berkeley Technology Law Journal, 2012 Vol.27, Annual Review of Law and Technology 241-271*, 246. Available at: <https://www.jstor.org/stable/24121686>

[64] Section 1(1) Patents Act; see also *Elizabeth F. Enayati, "Enemies of innovation: Protecting Biotechnology Inventions."* Computer High technology Law Journal Vol.5, 439 Available at: www.digitalcommons.law.scu.edu retrieved 13/2/2020

[65] Ibid

or other genetic materials, face the problem of falling outside the scope of patent protection depending on the law in the country.[66]

With the coming into force of the World Trade Organization's Trade Related Aspects of Intellectual Property Rights (TRIPS) agreements and the United Nations' Convention on Biological Diversity in 1994 and 1992 respectively, an obligation to pursue objectives and policies for the promotion and protection of intellectual property rights in technological innovations,[67]sustainable use and sharing benefits arising from the utilization of genetic resources and traditional knowledge is imposed on national governments.[68] Nigeria is a signatory to both the TRIPs agreement[69] and the Convention on Biological Diversity so promoting access to knowledge, technology and genetic resources in a manner that balances the rights of producers and users of inventions is required.[70]The patent regime under Article 27 of the TRIPS Agreement provides the scope for the protection of biotechnological inventions whether or not they relate to plant genetic resources as follows:

> (1) ..."patents shall be available for any inventions whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and capable of industrial application"...
>
> ... (3) Members may also exclude from patentability:
>
> (a) diagnostic, therapeutic and surgical methods for the treatment of humans or animals;
>
> (b) plants and animals other than micro-organisms and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes. However, members shall provide for the protection of plant varieties either by patents or by an effective sui generis system or a combination thereof. the provisions of this sub paragraph shall be reviewed four years after the date of entry into force of the WTO Agreement.

From the above, the general criterion for patentability is that an invention must be novel, comprises an inventive step and capable of industrial application, provided that plants, animals and essentially biological processes may be excluded from patent.[71]

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[66] Ibid

[67] Article 7 & 8 of the TRIPS Agreement

[68] Article 1, 8 &1 9

[69] Nigeria became a member of WTO on the 1st January, 1995

[70] Saeed Habiba, "Trips: Patenting of Biotechnological Inventions." Available www.sid.ir retrieved 14/1/22

[71] Article 27(1)

The courts have also intervened in cases to determine the scope of patents on genetic materials and products of nature. In the case of *Diamond v. Chakrabarty*,[72] The United States Supreme Court provided a distinction on patentability which covered biological materials. Although their position reaffirms the limitation on naturally occurring materials, it recognized human ingenuity in the invention of living organisms which were unknown natural phenomena.[73] In Chakrabarty's case, a genetically modified microorganism was created from a fusion of four different plasmids, a product used to degrade components of crude oil spills was claimed by the patentee. The court had the task to determine if the microorganism was naturally occurring or a manufacture.

Despite the judicial positions and legislative effort the issues of patenting biological inventions and genetic materials have remained inconsistent.[74] On a whole, different possible approaches have been provided thus;[75] (1) maintaining the status quo in the patents system and allowing other mechanisms to address the concerns relating to patenting life forms, (2) aligning the patents system to accommodate plants and animals to a limited extent, and (3) like any other invention, allow the patenting of life forms but create exceptions in cases.

In Nigeria, the patent system has maintained the status quo of prohibiting naturally occurring materials. However, the Plant Variety Act as well as other legislations like National Crop Varieties and Livestock Breeds (Registration) Act and the National Agricultural Seed Act addresses some concerns in relation to commercialization, registration, and protection of plant breeders' rights in biotechnological inventions and genetic materials.

Protection of Plant Variety

Introducing technology into the sphere of improving plant varieties and subsequently seeking its protection provides a potential change in the status of ownership of inventions in genetic material. From a common heritage of mankind to resources which can be privately or collectively owned.[76] Generally, genetic resources like plants as encountered in nature are not

[72] 447 US 303,303 1980

[73] Ghosh, n 63, 249.

[74] Ibid

[75] The Canadian Government in 1999 created the Canadian Biotechnology Advisory Committee (CBAC) with the brief to advise the government through the Biotechnology Ministerial Coordinating Committee on policy issues relating to the ethics, social, environmental, and health aspects of biotechnology.

[76] EEA n 27.

creations of man thus cannot be protected as intellectual property.[77] The effort of private sector seed industries for a form of intellectual property protection led to the use of plant variety and patents both providing exclusive monopoly over creations for a period.[78] As a result, plant varieties invented using genetic resources (whether associated with traditional knowledge or not) may be protected by plant breeders' rights or plant patents depending on the jurisdiction. Plant variety protection under plant breeders' right gives proprietary patent-like rights to breeders, as well as guarantee public interest and access to use of genetic materials.[79] In protecting plant varieties what gets protected is the genetic makeup of a specific plant variety.[80] Plant variety protection has worked well as a mechanism to promote the interest of commercial plant breeders by encouraging them to invest their resources to improve existing plant variants. Whether as individual enthusiasts, farmers, research institutions or multinational corporations, work to develop new plant varieties has become a necessity and cost-effective means of improving productivity, quality and marketability of crops for farmers and growers contributing to the sustainable progress in agriculture and development.[81]

International Protection for Plant Variety

The major treaty systems that regulate intellectual property protection in Plant Varieties are the Convention established by the International Union for the Protection of New Varieties of Plants (Union Internationale pour la Protection des Obtentions Végétales) UPOV, Food and Agriculture Organization's International Treaty for Plant Genetic Resources and the TRIPs Agreement administered by the World Trade Organization (WTO).[82] These systems each contain a comprehensive set of rules for their members regarding protecting property rights over plant varieties.

a. The Trade Related aspects of Intellectual Property Rights (TRIPs)Agreement

[77] Sachin Chaturvedi, "Agricultural Biotechnology and new trends in IPR Regime: Challenges Before Developing Countries." *Economic and Political Weekly, Vol. 37, 13,* 1212-1222. Available at: www.jstor.org/stable/4411924

[78] *Ibid*

[79] Article 1(VI), UPOV Convention as revised at Geneva on March 19, 1991 (Geneva, UPOV, 1992) p.5.

[80] *I*bid

[81] Ibid

[82] Lawrence R. Helfer, Intellectual Property Rights in Plant Varieties: An Overview with Options for National Governments 1-2, 2002 (FAO Legal Papers Online No. 31,), http://www.fao.org/Legal/prs-ol/lpo31/pdf 20/2/2020.

The TRIPs agreement is a World Trade Organization agreement adopted in 1994 with the objective to establish uniform international standards of intellectual property protection.[83] In addition to the patentability regime under Article 27, subsection(3) of the TRIPS Agreement earlier discussed, three ways of protecting plants and animal varieties were suggested thus; (1) patent law, (2) an effective *sui generis system* or (3) a combination of elements from both the patent and *sui generis* systems.[84] According to TRIPs, processes and essentially biological processes for the production of plants or animals may be excluded from protection[85]but plant-related innovations may be patented if they are inventions that are new, non-obvious and useful.[86]

From the above, the scope of protection for plant varieties currently required by TRIPs is still uncertain and members can enact some form of plant variety protection in form of patents, sui generis or a combination of both in their national laws.

b. International Union for the Protection of New Varieties of Plants (UPOV) Convention

The International Union for the Protection of New Varieties of Plants (UPOV) is an independent intergovernmental organization with a mission to provide and promote an effective system for the protection of plant varieties with the aim of encouraging the development of new varieties of plants for the benefit of society. UPOV administers the UPOV Convention which was signed in 1961 and came into force in 1968, it was later reviewed in 1978 and 1991.[87] The purpose of the convention is to ensure that members acknowledge the achievements of breeders of new varieties of plants by granting them an intellectual property right protection on the basis of a set of clearly defined principles.

The UPOV convention is a sui generis intellectual property rights protection for plant varieties adapted to protect plant breeders. Essential provisions of the UPOV Convention includes national treatment,[88] the eligibility requirements such as novelty, distinctiveness, uniformity and stability[89] which must be demonstrated to merit protection for a specific variety. Others

[83] Ibid
[84] *Ibid*
[85] Article 27(3)(a)
[86] Article 27(3) TRIPS Agreement
[87] *Ibid*
[88] Article 4 UPOV Convention 1991
[89] Article 7-9 UPOV Convention 1991

are exclusive right to authorize production or reproduction; conditioning for propagation, offering for sale, selling or marketing, exporting, importing or stocking for any of those purposes;[90] dual protection, compulsory licensing,[91] and a term of protection of 20 years, and requires a 25year term for tree and vine varieties. Article 15 of the convention provides for exemptions in cases of private non- commercial use, and research.[92] These exceptions would presumably permit peasant farmers to use protected seeds and other propagating material for their own consumption. There is also limited farmers privilege,[93] wherein each member state may enact a provision in its national plant variety protection laws permitting farmers to use for propagating purposes, the product of harvest that they obtained by planting a protected variety in their own holdings. This privilege according to the convention must be exercised within reasonable limits and subject to the safeguarding of the legitimate interests of the breeder.

Although UPOV system gave farmers, growers and breeders access to the best varieties produced by breeders throughout UPOV member territories, the Convention's biggest flaw however is the lack of acknowledgement of farmers' rights. In countries with large agricultural communities, mostly in developing countries like Nigeria, introducing a plant breeders' right legislation on the lines of UPOV model would amount to legislative marginalization of traditional farmers' rights to re-sow new varieties.

c. International Treaty for Plant Genetic Resources

Also worthy of mention is the international framework for managing access to crop genetic resources, the Food and Agriculture Organization (FAO) International Treaty on Plant Genetic Resources for Food and Agriculture, which was negotiated in 2001, and has now been signed by 146 contracting parties, including Nigeria, and came into force on June, 2004.[94] The treaty provides that the states retain sovereign rights over their genetic resources, including the right to designate genetic material and whole plants as intellectual property. The core provisions of the Treaty place the resources of thirty-six genera of crops and twenty- nine genera of forages in the public domain and guarantee access to these resources for breeding and research.

[90] Article 14.2 and 14.3 UPOV Convention 1991
[91] Article 17 UPOV Convention 1991
[92] Article 15 UPOV Convention 1991
[93] Article 15.2 UPOV Convention 1991
[94] FAO Legal Office, International Treaty on Plant Genetic Resources for Food and Agriculture, retrieved at: www.fao.org 21/2/2020

Germplasm from the multilateral system will be available under the terms of a material transfer agreement that may include provisions for benefit sharing in the event of commercialization. The Treaty states that recipients shall not claim any intellectual property or other rights that limit facilitated access to plant genetic resources for food and agriculture, or their genetic parts or components, in the form received from the multilateral system. In a bid to guarantee farmers' rights, the treaty admonishes national governments to do so through measures that will promote (a) the protection of traditional knowledge relevant to plant genetic resources for food and agriculture; (b) the right to equitably participate in sharing benefits arising from the utilization of plant genetic resources for food and agriculture; and (c) the right to participate in making decisions, at the national level, on matters related to the conservation and sustainable use of plant genetic resources for food and agriculture.

Protecting Plant Variety in Nigeria

Nigeria signed into law the Plant Variety Protection Act, 2021,[95] an Act that establishes the Plant Variety Protection Office, grants breeders' right in plant varieties and seeks to promote investment and crop productivity. This Act, in addition to non-intellectual property rights laws such as the National Crop Varieties and Livestock Breeds (registration) Act and the National Agricultural Seed Act to regulate the commercialization of plant varieties.

Modeled after the UPOV Convention, the new Act has the objective of promoting crop production for farmers and encouraging investment in the development of plant variety. Applicable to all plant genera and species,[96] the requirements[97]and scope of protection under the Act[98]is the same as under the UPOV Convention, the law grants intellectual property rights to plant breeders for new plant varieties excluding private non-commercial use, experimental purposes and acts of breeding other varieties.[99] For a list of agricultural crops a limited farmer's privilege was provided whereby the breeders right shall not exceed to a farmer who uses for propagation purpose his own obtained from planting his own holding provided that the legitimate interest of the breeder is safeguarded.[100]

[95] Section 57 of the Plant Variety Protection Act, 2021
[96] Section 12 PVP Act, 2021
[97] Section 13(1) PVP Act, 2021
[98] Section 29(1) PVP Act, 2021
[99] Section 30 PVP Act, 2021
[100] Section 30 (2) and (3) PVP Act, 2021

It is however observed that the new Act only provided a limited farmers' privilege as is the case with UPOV Convention and no mention of traditional knowledge associated with new plant varieties. Exceptions to plant breeders' rights such as compulsory licensing and pertinent provisions for farmer's rights and traditional knowledge are non-existent. With a large population of farmers in the country still engaged in small scale farming,[101]one cannot help but wonder if the true objective of the Act is to accommodate the interest of small farmers and the Nigerian farming preference or to propagate the interest of a few commercial plant breeders.

Benefits of Protecting Plant Varieties

The grant of protection for plant variety is generally designed to benefit the society through facilitating access to ideas and information contained in form of new varieties within and outside the country.[102] Although studies have shown that plant variety protection increases investments in breeding new plants under certain circumstances,[103]it provides economic benefits in form of higher yields and higher quality crops which assures breeders that they will be able to recoup cost of innovation.

Food security is directly linked to plant biodiversity, and the protection for farmers or breeders' rights recognizes their role in developing, conserving and enhancing biodiversity which in turn increases food production. It encourages the development of new and beneficial plant varieties with improved nutritional content for use by farmers and consumers alike.[104] Plant variety protection system also provides important benefits in an international context by ensuring compliance with obligations undertaken under international treaties like the TRIPs Agreement, Convention on Biological Diversity etc thereby removing barriers to trade and increasing domestic and international market scope.

Contribution to Nigerian Economy

With a population of about 230 million people estimated to nearly double to 400 million by 2050,[105]there is a need to enhance investments in major sectors of the economy especially

[101]Titilayo Adebola, "Breaking the Silence on Plant Variety Protection in Nigeria." Available at www.floraip.com retrieved 20/1/22

[102] L. R. Helfer, "Intellectual Property Rights in Plant Varieties: An Overview with Options for National Governments"pt1, FAO Legal Papers Online, 2002, 2.

[103] R. Tripp, N. Louwaars & D. Eaton, Plant Variety Protection in Developing Countries. A Report from the Field, Food Poli 32 (2007) 354-371. Available @ www.sceiencedirect.com

[104] Ibid

[105] Alliance for Green Revolution in Africa (AGRA), "Seed Legislation: Nigeria Takes Step to Secure the Legacy of Plant Breeders and Foundation Seed Producers." Available at: <www.agra.org>

healthcare and agriculture to meet the food and health care needs of the growing population.[106]Plant use in relation to biotechnology particularly agricultural biotechnology is known to produce value added products both in terms of increased production and nutritional advantage. This have become a means of economic development because of its contributions in the following areas:

(a) Addressing the enormous challenges facing the agricultural sector in Nigeria.

Nigeria currently faces gaps in the agriculture sector including low productivity levels which has a bearing on its per capita income and food availability for the growing population.[107] By developing high yielding hybrids, productivity is enhanced and so is the economy. Also, obsolete agricultural practices and the absence of skilled human resource[108]resulting from lack of awareness, knowledge, and the inability to assess technology to resolve agricultural problems has been closely linked to the absence of research infrastructure and funding which may be addressed by investments in biotechnology.

The country's inability to fund basic science research in the public sector due to low allocation for research and development has become a source of worry as a result of which alternative sources of funds are required. Biotechnology allows for nongovernmental research funding, international organizations, and private plant breeders willing to invest especially where they are assured that there is adequate protection.[109] Experts say that biotechnology can help to conserve plant genetic resources from the deteriorating conditions of the environment resulting from the adverse effect of climate change, strained land and water supply, leading to reduced land mass and low productivity.

(b) The Benefits of Biotechnology:

Plant biotechnology delivers significant benefits to farmers, consumers and the environment. Biotechnology through the revolutionary gene-editing technology, genetic modification, inter-specific crossing can produce cost effective, disease

[106] S. A. Olasoju et al, 'Problems and Prospects of Agricultural Biotechnology in Nigeria's Developing Economy', *World Academy of Science, Engineering and Technology International Journal of Agricultural and Biosystems Engineering 2018 Vol.12, No. 11,1.* Available at: <http://www.zenodo.org>

[107] Ibid

[108] J. T. Opabode & O. C. Adebooye, Application of Biotechnology for improvements to Nigerian Indigenous Leaf Vegetables, *African Journal of Biotechnology 2005 Vol4 (3) 138-142 Feb.,* 4. Available at:<http://www.academicjournals.org/AJB> 3/5/22

[109] Charturvedi. n77.

resistant, and develop specific characteristics in plants with enhanced features.[110]Micropropagation of crops like yam ginger, cassava and banana, genetic engineering of disease resistant cowpea and cotton, and development of the super cassava are all commendable developments in biotechnology in Nigeria. Development of high yielding hybrids using traits from traditionally produced plants from indigenous communities could lead to cost saving and boost farm income to the extent that importation of crop plants for pharmacological use and cereal crops like rice etc can be eradicated. [111]

(c) The Prospects for Biotechnology

Biotechnological milestones in the agricultural sector over the years are poised to explore economic opportunities in genetic resources with emphasis on research, field trials and commercialization of approved crops.[112]By unlocking the agricultural potentials, significant contributions can be made to the economy of the country.[113]Although as at march 2021, Nigeria is estimated to contribute only an estimated $833.34 Billion to the global biotechnology industry with only a 7.02% growth rate by 2027.[114]

Nigeria has continued to show prospects in biotechnology since the emergence of the Nigerian Biotechnology Policy in 2001, the establishment of the National Biotechnology Development Agency (NABDA) with the mandate to promote, coordinate and set research priorities in biotechnology in Nigeria. The Nigerian Biosafety Management Agency has in recent times made significant strides in the invention and distribution of genetically modified crops such as cotton, cassava and cowpeas in advancing economic development in the country.

Also worthy of note is that biotechnology is a specialized field that requires highly skilled personnel whose success is largely predicated on their findings from the laboratories. So, start-up biotech laboratories like 54gene (a privately funded laboratory) in Nigeria have increased the potential of commercial research in the

[110] Ibid 141

[111] Titilayo Adebola, Examining Plant Variety Protection in Nigeria; Realities, Obligations and Prospects. *J World Intellect. Prop 2018: 1-23, 2.* Available at: <https://www.wileyonlinelibrary.com/journal/jwip>

[112] Nkechi Isaac, Nigeria's 2017 prospects for Biotechnology' Alliance for Science 2017, available at <http://www. allianceforsceince.cornell.edu>

[113] Ibid

[114] O. Familoye & I Neto, '54 Gene, COVID-19 and the prospect of Human Biotechnology in Nigeria' accessed at: <http://www.techcabal.com>

unexplored genetic resources in the country. Increasing non- governmental research funding will offer opportunities to interested scientists and collaborations in high impact and integrative research discoveries.[115] These will help to achieve a vision to create a market-driven system, capable of producing and distributing high quality and improved planting materials that are available, accessible. Collaborations between local farmers, indigenous communities and institutions must be encouraged.[116]

Conclusion

Nigeria is rich both in biodiversity and traditional knowledge which is the raw material upon which plant varieties and biotechnology is developed. While the importance of conservation methods like gene banks for material subjects cannot be overemphasized, the protection of knowledge and inventions in biotechnology derives mainly from the benefits that can be achieved in the fields of medicine, agriculture, and the environment. A country's ability to protect the century old knowledge and new knowledge that can together be converted into wealth to decide its future is crucial for its continuous existence. Integrating biotechnology in plant breeding and traditional methods therefore can be tailored to create a balanced future which will not only give direction to possible uses but also assess their compatibility. Appropriate government policies and legal framework for wide dissemination of improved plant varieties is no doubt a step in the right direction, while reflecting on the realities of farmers in the country is expedient for economic growth.

[115] Ibid

[116] Ifeanyi. E. Okonkwo et al, "Overview of Nigeria's Plant Variety Protection Act,2021 and the impact of section 43(2) on Plant Breeders." Available at: https://ssrn.com/abstract=3928965 retrieved 19/1/22