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Synthetic Rhino Horns as a Conservation Method

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The word rhinoceros comes from the Greek language, “rhino” translates to “nose” and “ceros” to “horn”. There are five species and eleven subspecies of rhinoceroses, some of these species have one horn, while others have two.¹ Three of those five rhino species are considered to be ‘critically endangered’ by the International Union for Conservation of Nature (IUCN), while the other two are ‘near threatened’ and ‘vulnerable’. Generally, rhinos are classified as facing a high threat of extinction in the wild; the subspecies of the Northern White Rhino is now only populated by two female rhinoceroses, the last male died in sanctuary in March of 2018. Thus, the fate of the Northern White Rhino rests in potential In Vitro Fertilization (IVF), technology that has yet to have been proven to work or utilized, and for this reason they are often classified as extinct in the wild.²

Wildlife crime, specifically poaching, is the biggest threat to global rhino populations. As National Geographic photographer Ami Vitale wrote on the Northern White Rhino “we are witnessing the extinction of a species that had survived for millions of years but could not survive mankind”.³ Humans have caused the drastic decline in global rhino populations, dominantly through poaching, but habitat destruction and pollution have also contributed to the large decline from 70,000 rhinos in 1970 to less than 28,000 today. Poaching of rhinos is such a large threat because of the extremely high value of wild rhino horns: in terms of price per unit weight, rhino horns are currently more valuable than gold, diamonds, and cocaine.⁴ Demand for rhino horns is generated in South East Asia because in various cultures rhino horn is believed to cure cancer, hangovers, and blood disorders, while in others it is thought to increase sexual

¹ Bradford, A. (2018) Facts About Rhinos.

² Gibbens, S. (2018) After Last Male’s Death, Is the Northern White Rhino Doomed?

³ Ibid.

⁴ Chen, F. (2017) The Economics of Synthetic Rhino Horns

potency in men, and in others horns serve as indications of a very high social status, wealth, and importance. Around 2008, a rumor circulated that rhino horn had cured a Vietnamese politician's cancer, and after this demand for it grew exponentially in Vietnam.⁵ Rhino horns are illegally supplied through sophisticated transnational organized crime networks, commonly referred to as the 'Black Market'.⁶ Poaching of rhinos has steadily and quickly increased since 2008; for the last five years, rhinos have been poached at a rate of 3 per day.

Rhino preservation has become a pressing issue in the conservation field, due to their decreasing populations and the fact that they are an 'umbrella species', a term that signifies that rhinos hold, and have held for fifty million years, important roles in a wide range of ecosystems, and the survival and wellbeing of other animal, plant, and insect species depend on rhinoceroses. When rhinos are protected, so are these many other species and thus global biodiversity as well. Poudyal, Rothley, and Knowler's (2009) investigation of the one horned rhino in Nepal, found that under current rhino poaching prevention strategies, the population is going to continue to be at large risk, most likely reaching extinction.⁷ Thus calling for some sort of adaption to rhino conservation methods.

Synthetic rhino horns, or fake-manufactured rhino horns are a potential conservation method that could be utilized to decrease poaching and therefore save rhino populations. In this thesis a theoretical discussion of various economic theories and models will be utilized to explore the possibility of synthetic rhino horns as a conservation method aimed at potentially deterring poaching of wild rhinos for their horns. The goal of these synthetic rhino horns should

⁵ Actman, Jani. (2015) Can Fake Rhino Horn Stop the Poaching of a Species at Risk?

⁶ Save the Rhino. (2016) IUCN Reports Deepening Rhino Poaching Crisis in Africa

⁷ Poudyal, M., Rothley, K., and Knowler, D. (2009) Ecological and Economic Analysis of Poaching of the Greater One-horned Rhinoceros (*Rhinoceros Unicornis*) in Nepal

be to cause uncertainty in the minds of buyers and so create a type of Market for Lemons, as in Akerlof (1970).

Literature Review

Conservation of endangered species is a well explored subject, many academic articles and proposals exist on wildlife preservation. Yet, there is barely any existing literature on synthetic rhino horns. This is because they have not yet been utilized as conservation method. The delay on production is due to the existence of dissent surrounding the positive effect of synthetic rhino horns on wild rhino populations. Organizations such as Save the Rhino International (SRI) and the International Rhino Foundation (IRF) published a statement that they were “opposed to the development, marketing, and sale of synthetic rhino horn” because of concerns such as the synthetic rhino horns unintentionally increasing the demand for real or wild rhino horns, and producing synthetic rhino horns potentially giving credibility to the claim that rhino horns have medicinal value, which they have not been scientifically proven to.⁸ Their concern lies in synthetic rhino horns and wild rhino horns being perceived similarly by consumers, and making rhino horns more available and publicly known through synthetic production could increase demand for rhino horns in general. Furthermore, they fear that this production could de-stigmatize the purchasing of rhino horns, and contribute to an increased demand, which would drive the price for wild rhino horns up, and therefore increase poachers’ incentives.

Economic literature on the protection of endangered species through substitution conservation methods does exist and supports theory behind synthetic rhino horns as a

⁸ Save the Rhino. (2015). Synthetic rhino horn: Will it save the rhino?

conservation method. For example, *Elephants and Mammoths: Can Ice Ivory Save Blood Ivory?* by Farah and Boyce et al., in which the authors explore the possibility of replacing elephant ivory with mammoth ivory in order to reduce elephant poaching. They assume mammoth ivory to be an imperfect substitute to elephant ivory, and assume both mammoth and elephant ivory to be openly available. Through an empirical and theoretical analysis of the effect of Russian mammoth ivory on the seizure of elephant ivory, they find that per one ton of mammoth ivory exported elephant ivory seizure would decrease by any amount from 0.59 to 0.77 tons. This mammoth ivory export to elephant ivory protection ratio translates to about 50,800 elephants being saved from poaching in a year, given the current amounts of mammoth ivory available to be utilized. Furthermore, they find that mammoth ivory causes a decrease in the price per kilogram of elephant ivory, suggesting that policies that make substitutes readily available, will lower the demand for the resource being substituted for.⁹ In summary, substituting mammoth ivory for elephant ivory could help save elephant populations from poaching and eventual extinction.

An industry that more closely parallels synthetic rhino horn production in order to decrease rhino poaching, is the production of faux-fur to decrease furred-animals slaughter. The chapter “Sustainable Production and Consumption Within Animal-Based Luxury and Fashion Products” of *Textiles and Clothing Sustainability*, examines the contrasting effects and perceptions of faux-fur on the fur fashion industry. They discuss what leads a consumer to consume sustainable products or not, including motives of appearing altruistic, a desire for a heightened social status, and an influence from their surrounding culture. The chapter also points out how in cold climates, faux-fur is not a suitable substitute because of how it does not have the

⁹ Farah, N., Boyce, J. (2015) *Elephants and Mammoths: Can Ice Ivory Save Blood Ivory?*

same warming-ability as real fur does. So, the people switching from real fur to faux fur will not be located those regions, for example northern Russians will not substitute real fur for faux fur. Additionally, the authors consider other environmental impacts of synthetic and real fur, such as the resources it takes for minks to be fed and sustained in order to kill them and obtain their fur. Considering this, real fur is found to be much more environmentally harmful than fake, synthetic, or faux fur. They find that because of market demands, the fashion industry will continue to have both real fur and faux-fur products, not necessarily decreasing the amount of real fur used, or animals killed in the production of real fur. Additionally, organizations such as People for the Ethical Treatment of Animals (PETA) that raise awareness around animal abuse, encourage consumers to favor faux-fur if they are inclined to decrease animal abuse.¹⁰ Finally, they find that status will continue to drive the demand for real fur, regardless of the coldness or need for warmth and the known animal abuse.

An issue that conservation surrounding the fur industry faces, despite tactical attempts such as faux fur, is the poorly regulated fur trade. For example, in 2000, the United Kingdom banned fur farms from existing through a national probation, followed by some other European countries.¹¹ Yet, the UK continues to be a factor in the over 1 billion rabbits and 50 million other animals (foxes, seals, mink, raccoons, and dogs) killed for their pelt to be used in fur. Much of this fur is imported from China and other countries that have poor regulation of the fur trade, and fur that is not faux is commonly labeled as faux.¹² In this sense, faux fur has not been successful in diminishing the animal slaughter that goes in to producing fur, and the rate that they are being killed at is not expected to slow.

¹⁰ Muthu, S. S. (2017). *Textiles and Clothing Sustainability: Sustainable Fashion and Consumption*.

¹¹ Fur Free Alliance. *Fur bans*.

¹² Last Chance for Animals. *Fur Trade Facts*.

Other proposed conservation methods for endangered species include the privatization of wildlife, and the legalization of wildlife trade where it has been previously banned. The term ‘wildlife ranching’ has been given to the practice of wildlife recreation and wildlife product reproduction. The advantage of this conservation tactic is that the private owner of the wildlife receives a positive economic return, and therefore has incentive to conserve the wildlife.¹³ A prominent example of this in the United States is cattle, because of the profits gained from beef and milk, cattle ranchers have incentive to sustain the population of cows; it is very unlikely that cows will go extinct for this reason. However, rhinoceroses are not as easily domesticated, they are more aggressive and reproduce more slowly than other domesticated animals, making this an unlikely avenue for rhinoceros’ conservation.

Animals that are illegally killed by trophy hunters have begun to be auctioned off as an attempt to regulate the market for trophy kills. For example, there has recently been public backlash against the selling of a rare white lion as a trophy kill.¹⁴ Tactics like this, and the one employed by the Alberta National Park in auctioning off big horn sheep to hunters, are meant to regulate the market and control the amount animals being killed, monitoring population rate.¹⁵ This conservation method generates income for the group regulating the market, and in the case of Alberta, is utilized to fund wildlife research that otherwise would not exist. Legalization and regulation of the rhino horn market, along with overturning the current trade ban, aim to drive down the market price of horns through releasing stockpiled horns in auctions. However, this

¹³ Butler, M., Teaschner, A., Ballard, W., McGee, B. (2005) *Wildlife Ranching in North America: Arguments, Issues, and Perspectives*

¹⁴ Simmons, K., Rosenblatt, K., (2018) *Rare White Lion Named Mufasa Faces Auction Block in South Africa*

¹⁵ Sid, M. (2002) *Sacrificial RAM: Alberta's Trophy Hunt Auctions, Have Raised Millions to Support Wildlife Research the Province No Longer Funds. (Wild Life).*

market regulation and stockpile collection would have to be done using captive breeding programs (CBPs) for rhinos. For rhinoceroses this would require spatial and costly terrain, and their aggressiveness would once again inhibit feasible domestication and stockpile collection of their horns.¹⁶ Furthermore, current rhino populations are much lower than other wildlife populations, and they reproduce at a slower rate. Other regulated wildlife industries, like crocodile skin, were established in existing well-regulated industries, enabling them to be monitored and carried out proficiently. Meanwhile rhino horns are currently used in an unprocessed form mainly in China and Vietnam, which are known for weak control of their drug industries, specifically.¹⁷ Suggesting that market regulation would not be an effective conservation method for rhinoceros' horns.

Conservation and rhino poaching prevention methods require improvement, and without it there is a grim future for global rhino populations. As shown by the global, continued decrease of rhinoceros populations, along with case studies such as the one done in Nepal's Royal Chitwin National Park, rhino conservation methods have not been successful in saving the populations. However, poaching is a complex problem, influenced by many different factors such as the price of rhino horn on the international market, local socioeconomic factors, and the population dynamics of the species. Therefore, few studies have attempted to address this complexity.¹⁸ The case of the greater One-Horned rhinoceros in Nepal was a study attempting this, and Poudyal et al. concluded that current rhino conservation is not going to be effective in saving the population. Furthermore, they claim that 'long-run control, antipoaching policies should be directed at

¹⁶ Collins, A., Fraser, G., Snowball, J. (2016) Issues and Concerns in Developing Regulated Markets for Endangered Species Products: The Case of Rhinoceros Horns.

¹⁷ Prins, H., Okita-Ouma, B. (2013) Rhino Poaching: Unique Challenges.

¹⁸ Poudyal, M., Rothley, K., and Knowler, D. (2009) Ecological and Economic Analysis of Poaching of the Greater One-horned Rhinoceros (Rhinoceros Unicornis) in Nepal

increasing the opportunity costs of poaching by creating better alternative economic opportunities, and at antipoaching enforcement'.¹⁹ Other studies have been done examining the impact of specific conservation methods on rhino populations. Berger and Cunningham found that the practice of dehorning rhinoceroses in order to decrease the incentive for poachers is unlikely to be an effective prevention strategy in areas with dangerous predators (such as poachers), and conclude that their study highlights the importance of experiential conservation/prevention strategies in protecting rhinoceroses.²⁰ Rabinowitz studied vulnerable populations of Sumatran rhinos in Borneo, and concluded that the long-term conservation practice of capturing and breeding Sumatran rhinoceroses has ultimately failed in salvaging rhino populations.²¹ Rhino populations are dependent on new, innovative conservation tactics to ensure their long term survival, and the synthetic rhino horn is the current 'hot-topic' being considered.

The Market for Lemons, adverse selection, and uncertainty in the consumers has been examined in other fields, and by Akerlof himself in the used-car industry. However, like the market for wild rhino horns, there are other markets that humanitarian or philanthropic groups and advocates wish not to exist. The market for drugs is an example where uncertainty could also play a role in reducing or collapsing the market for benevolent reasons: less abuse, overdoses, and other harm caused by drugs. In the Economics of Illegal Drug Markets, the authors question how this market has not collapsed because of the inability to know the purity of illegal drugs when purchasing; "The inability to know the quality of drugs before purchase, combined with

¹⁹ Ibid.

²⁰ Berger, J., Cunningham, C. (1994) Phenotypic Alterations, Evolutionarily Significant Structures, and Rhino Conservation

²¹ Rabinowitz, A. (1995) Helping a Species Go Extinct: The Sumatran Rhino in Borneo.

the unenforceability, means the drug market is always on the brink of collapse”.²² However, it is concluded that the reason the market is able to exist, has not collapsed yet, is because of repeated interactions between the same buyers and sellers. This reduces the incentive for rip offs and reduces the uncertainty in consumer’s minds in the illegal drug market. For rhinoceros horns the networking of purchasing it, purpose or use of the rhino horn, and the frequency of horn purchases must be taken into consideration in determining whether or not this developed trust between buyers and sellers would be established like it has been in the illegal drugs market.

There is little economic literature on synthetic rhino horns because they have not been produced and utilized yet. Professor Frederick Chen, in his article *The Economics of Synthetic Rhino Horns*, is the first to explore the possibility of synthetic rhino horns through the lens of economic theory. The article’s main strength is that the fact that it the first to use economic principles to predict how this new conservation tactic, synthetic rhino horns, would affect poaching and wild rhino populations. Chen utilizes a theoretical model of rhino horns, in which only two goods exist, wild rhino horns and synthetic rhino horns. He assumes that high quality synthetic rhino horn producing firms exist, high quality in the sense that these synthetic rhino horns are indistinguishable and bio-identical from wild rhino horns. Chen also assumes that these firms are profit maximizing firms, and that the cost of supplying a synthetic rhino horn is less than a wild rhino horn. Once Chen establishes this theoretical market with his assumptions, he progresses into discussing the importance of the suitability of the synthetic rhino horn (how it is perceived by consumers in comparison to wild rhino horn) and the market structure of synthetic rhino horn producers. He explores the possibilities of the synthetic rhinos being perceived as

²² Persico, N., Galenianos, M., Pacula, R. (2015) *The Economics of the Illegal Drug Market*. Kellogg School of Management at Northwestern University.

inferior, superior, and perfect substitutes to wild rhino horns by consumers, with the synthetic rhino horn production being monopolistic and then perfectly competitive. His main finding is that the market structure and the suitability of the synthetic rhino horn are what determine if there is a decrease in poaching of rhinos, and what the magnitude of that decrease would be.

Practical Implications of Synthetic Rhino Horns

A bioengineering company based in the United States, Pembient, began exploring the potential of synthetic rhino horns back in 2015. The company is founded on “a vision of the world without wildlife poaching” and the understanding that new ideas need to disrupt the markets for wildlife goods in order to save endangered populations. Pembient wants to begin larger production of fake, bio-fabricated rhino horns by injecting rhino genetic code into yeast adding rhino DNA, and then 3-D printing horns using this substance.²³ Originally, Pembient released plans of these synthetic horns being marketed as a powder, and several companies were interested in combining it with items like beer and skin cream to be sold to Southeast Asian consumers. However, this received a very high amount of backlash from conservationists because it would be creating “entirely new uses of rhino horn that will reach an entirely new audience” as the international director of Save the Rhino, Cathy Dean, stated.²⁴

From here, Pembient shifted its plans back towards producing rhino horn products in the durable goods market, such as ‘carvables’ and jewelry. Pembient has created prototypes of these items and is hoping to get them out into the market by 2022.²⁵ However, the company plans to market these synthetic horns, or products derived from them, as artificial rhino horns, and at a

²³ Pembient. (2019). Conservation.

²⁴ Actman, Jani. (2015). Can Fake Rhino Horn Stop the Poaching of a Species at Risk?

²⁵ Peters, Adele. (2018). Synthetic Rhino Horns are supposed to disrupt poaching. Will they work?

price of about one eighth of the reported \$60,000 per kilogram authentic rhino horns currently command.²⁶ CEO of Pembient, Matthew Markus envisions the introduction of these goods driving down the price of real rhino horns; by offering an eco-friendly alternative the company thinks demand for real rhino horns will drop, therefore diminishing the economic incentive for poachers, and reducing the number of rhinos being killed.²⁷ Pembient envisions that the low price of their synthetic rhino horns will result in Pembient making the money offered in the horn market, and the poaching syndicates seeing their profits disappear as the synthetic option becomes more popular. Pembient's ideology is rooted in a profit-based mechanism to reduce poeaching of wild rhino populations.²⁸

The conservation community is outwardly against the production of rhino horns that are marketed as an artificial alternative to real ones. Multiple groups have released dissenting statements to Pembient and the other companies who have expressed interested in producing synthetic rhino horns. Likewise, the Center for Biological Diversity, a U.S. based group that utilizes the law and science to protect the environment, filed a petition to the U.S. Fish and Wildlife Service requesting a ban on trading fake rhino horns. The petition justifies the ban with a few reasons: trade in cultured rhino horn provides cover for the illegal trade, legal markets of ivory previously facilitated the laundering of illegal ivory from newly killed elephants; bio-fabricated horns would make law enforcement more difficult, as traffickers could claim their genuine horns to be fake; these synthetic rhino horns will expand consumer demand for horns in general, because of the lower price making the product affordable for less affluent consumers;

²⁶ Actman, Jani. (2015). Can Fake Rhino Horn Stop the Poaching of a Species at Risk?

²⁷ Ibid.

²⁸ Neme, Laurel. (2016). Petition Seeks Ban on Trade in Fake Rhino Horn.

and the development of legitimate sales for profit may lend credibility to the unproven claims of rhino horn's medicinal value, undermining the initiative to reduce demand for rhino horns worldwide.²⁹ Professor Chen agrees that introducing an alternative artificial product would risk increasing the demand for horns in general, thus increasing the economic incentive of poaching, and exacerbating the rhino population's decline. He also identifies how there are more than one way to flood the market with these products, and how conservation groups tend to clump the different strategies related to synthetic rhino horns together and reject them all.³⁰

Introducing synthetics into the market that pass as real rhino horn because they are chemically and biologically identical, or close enough to identical to real rhino horns, and have some sort of negative consequence is the path Chen suggests pursuing. The negative consequence could be that ingesting the synthetic rhino horn triggers some sort of stomach ache, or simply could be that a consumer spent \$60,000 per kilogram on a rhino horn product that is fake, and thus does not have the rarity or reputation of the raw material that they desired. The potential of these chemically convincing rhino horns now seems to lie in the development of synthetics made from horsehair.³¹ Horsehair has become the best option in creating a confusingly similar synthetic horn, because rhinoceroses and horses share a common ancestor, likening their DNA structures. Additionally, keratin, what primarily forms rhino's horns, is the same protein that is found in hair.³² Dr. Vollrath, a biologist at the University of Oxford, in conjunction with colleagues at Fudan University in China, have utilized hair from horse tails to create a prototype that looks identical to rhino horn under a microscope. The synthetic rhino horn

²⁹ Ibid.

³⁰ Nuwer, Rachel. (2019). Scientists Created Fake Rhino Horn. But Should We Use It?

³¹ Ibid.

³² Kooser, Amanda. (2019). Scientists create fake rhino horn out of horse hair.

also has a similar chemical signature, behaves like rhino horn when cut or shaved, and smells the same as authentic rhino horn when burned.³³ Thus, creating what seems to be the type of synthetic that Professor Chen suggests, and a product that allows for Akerlof's market for lemons to be employed in the conversation surrounding the economics of rhino preservation.

Akerlof's Market for Synthetic Rhino Horns

Akerlof's market for lemons relates quality and uncertainty and explains the economic losses of dishonesty in a market in which there are suitable goods and 'lemons' which are inferior goods disguised as suitable goods.³⁴ When examining the practices of adverse selection, the level of information sellers and consumers have, in a competitive market, is crucial in determining the outcome of the lemons' presence in the market. If there is full information, meaning that sellers know whether they have a lemon or not, and buyers can distinguish between the lemons and suitable goods, then considering two markets is necessary: one for lemons and one for suitable goods. Thus, there are two prices, one for lemons and one for suitable goods and within competitive markets these are equilibrium prices result where the supply and demand for each good are, respectively, equal. However, these markets are not mutually exclusive, so the equilibrium price for lemons and for suitable goods need to be found simultaneously and in conjunction to clear the two markets.³⁵ Pembient's plans to sell rhino horns marketed as artificial reflects the application of Akerlof's model to a competitive market with full information. It can be assumed that artificial, fake, synthetic rhino horns, despite their method of creation or form of marketing will be perceived as lemons in the eyes of Southeast Asian consumers. In a truly

³³ Nuwer, Rachel. (2019). Scientists Created Fake Rhino Horn. But Should We Use It?

³⁴ Akerlof, G. (1970) The Market for "Lemons": Quality Uncertainty and the Market Mechanism.

³⁵ USCB Department of Economics. Adverse Selection: A "Lemons" Market

competitive market, we know that the long run efficient outcome is for all goods that are supplied, lemons and suitable, being sold. The price of the good, and the consumer value, and resulting consumer surplus from purchasing a rhino horn, either synthetic or real, is what determines the quantity of each good being sold.³⁶ A market with full information for buyers and consumers would not result in a complete reduction of authentic rhino horns being produced through poaching, in the way a market with asymmetrical information would.

Asymmetrical information occurs when traders on one side of the market know the status of a good, as a lemon or suitable good, and the traders on the other side of the market do not.³⁷ The problem presented in this market is because traders who have the detailed information, (suppliers) may benefit from concealing or misrepresenting the goods. Buyers cannot distinguish between the two types of goods, and in this case the two types are synthetic and real rhino horns. Thus, there is only one price and one market for the good, rhino horns. The buyers' decision to purchase a horn now incorporates an uncertainty of the quality of the good. Furthermore, individuals in this market know that with the probability q it is a suitable good, and with probably $1 - q$ it is a lemon, and by assumption q is the proportion of real rhino horns produced, and $1 - q$ is the proportion of synthetic rhino horns produced.³⁸ Overtime, the proportion of rhino horns being produced, q , will be decreasing due to the continuous decline of their population, but also hopefully because of successful anti-poaching measures. Contrastingly, if Dr. Vollath and colleagues are able to successfully produce an indistinguishable synthetic rhino horn, production of lemons could be increasing overtime. Thus, the probability of receiving a lemon,

³⁶ Ibid.

³⁷ Ibid.

³⁸ Akerlof, G. (1970) The Market for "Lemons": Quality Uncertainty and the Market Mechanism.

$1 - q$, while paying full price for a rhino horn, would be increasing. This uncertainty introduced to the market, would taint the market and destroy consumers' trust in purchasing a rhino horn, and most likely be magnified by the extremely high prices of products derived from rhino horn. Resulting in the market for rhino horns collapsing, as no consumers will want to buy a rhino horn as it becomes increasingly likely that is a lemon, which they are unable identify for themselves. Akerlof uses Gresham's Law, which explains how 'bad' money drives out the 'good' money in a bimetallic system of currency, as an analogy for how the lemons would drive the suitable goods out of the market.³⁹

An indistinguishable synthetic rhino horn being produced enables the possibility of Akerlof's market for lemons being realistically applied to the case of rhino horns. Thus, presenting an opportunity for the market for rhino horns to collapse, removing the economic incentive for poachers, and saving global rhino populations from their most imminent threat. Professor Chen explores the implications of synthetic rhino horns, in *The Economics of Synthetic Rhino Horns*, concluding that the market structure and substitutability of the synthetic rhino horns determine its effectiveness in reducing the poaching of rhinos.

Expansions of Chen's Models of Synthetic Rhino Horns

Professor Chen's analysis of synthetic rhino horns is also applicable to the various developments of the potential conservation method thus far. He finds that synthetic rhino horn producers would benefit the most by promoting their products as superior substitutes to real rhino horns. This marketing strategy portrays the synthetic horns as distinguished from the real ones, and superior to them for reasons such as environmental friendliness or the lack of

³⁹ Ibid.

contamination of the bio-fabricated products compared to the contaminated horn of a wild animal.⁴⁰ Pembient's plans of synthetic powder or durable goods follows this logic, and in agreement with the conservationists, Chen points out how putting out a superior substitute could backfire on rhino populations. Specifically, he states that if the synthetic rhino horns were to be considered higher quality or superior to real rhino horns, then the average quality of goods in the rhino market would increase. Therefore, consumers' willingness-to-pay and the price of rhino horns would increase, and poachers would have a larger incentive to kill rhinos. Oppositely, Chen discusses the possibility of synthetic rhino horns being perceived as an inferior substitute, and being indistinguishable from real horns, or at least the cost of distinguishing them being prohibitive. He declares that if there is a monopoly on synthetic rhino horns, some wild horn suppliers would be able to remain in the market, but if the synthetic rhino horns production is perfectly competitive, no wild horn suppliers, or poachers, would remain in the market – similar to Akerlof's conclusion that the market will collapse with the presence of indistinguishable lemons.⁴¹

Professor Chen's model could be expanded in various ways to better reflect the developing rhino horn market and production possibilities of synthetic rhino horns. The model assumes that the synthetic rhino horn producers are all profit maximizing firms, meaning that each firm will focus on the commercialization of their product, possibly having an additional altruistic motive of reducing poaching, like Pembient. However, because of the large opposition to this approach from various conservation groups, including the petition to ban the trade of artificial horns, it is more realistic to assume that the synthetic rhino producers will not function

⁴⁰ Chen, F. (2017) *The Economics of Synthetic Rhino Horns*

⁴¹ *Ibid.*

as profit maximizers in the way Pembient has planned for. Rather, the firms are more likely to be not-for-profit entities solely aimed at saving rhino populations if synthetic rhino horns are ever to be implemented and supported by the conservation community. Synthetic rhino horns like that of Dr. Vollrath's prototypes being accepted by the conservation community, utilized exclusively with the altruistic motive of reducing poaching, and specifically as a method to reduce demand for real rhino horns is the most likely avenue for this potential conservation method. For profit maximizing companies the objective function is maximizing revenue and minimizing costs. But there is no absolute consensus on not-for-profit entities' objective functions, but rather they prioritize the benevolent motives involved in the founding of their company.⁴² And in this case, the primary altruistic motive would be to save an endangered species by decreasing consumption of rhino horn and therefore poaching.

Professor Chen explores the possibility of synthetic rhino horns being considered inferior, perfect, and superior substitutes for wild rhino horns. However, it is more realistic to assume that synthetic rhino horns will be perceived as inferior substitutes to wild rhino horns by consumers. This assumption is crucial to the collapse of the market for authentic rhino horns when flooded with lemons. If the synthetic rhino horns are identical, or too costly or confusing, to distinguish from the real wild rhino horns, but not considered to be lesser in some way, then the market will not collapse and the synthetic horns could have negative effects on rhino populations. However it is realistic to assume that the synthetic rhino horns would not be considered superior or perfect substitutes for authentic ones because consumers' understanding of the horn as highly valuable is rooted in the perception of rhinoceroses as mystical beasts who have roamed the earth for 50 million years. There is a certain masculinity that is involved with removing and owning the horn

⁴² Malani, A., Philipson, T., & David, G. (2003). Theories of Firm Behavior in the Nonprofit Sector.

of a beast, similar to the virility conceived from hunting a lion or other exotic animals that a synthetic horn cannot provide. Furthermore, because synthetic rhino horns do not have any proven medicinal or scientific value, the belief that they cure various diseases or health disorders lies in the understanding that rhino horns have some sort of curability because of their mythical aspect or powers. However, western media and understanding heavily overestimates the consumption of rhino horns in Southeast Asia for medicinal purposes. A study of consumers' reasoning for purchasing a rhino horn showed that it now serves as more of a positional good than any else. Exploring this when pursuing the production of synthetics is important in evaluating the success of them as a conservation method.

Rhino Horns as a Positional Good

A media content analysis between Chinese and western newspapers from 2000 to 2014 was utilized to examine the difference between the two cultures' perceptions of wild rhino horn consumption in Southeast Asia.⁴³ Western media alleged consumption of rhino horn in China to be overwhelmingly due to its perceived medicinal value. Reporting that 84% of rhino horn acquisition and consumption was due to the belief that it has scientific powers, such as curing cancer, blood disorders, or hangovers. Furthermore, the west has disproportionality alleged rhino horn consumption to be related to the belief that it increases male sexual potency, which was not referenced as a reason for its acquisition and consumption in Chinese media. These misallocations of the reasoning for rhino horn consumption is problematic because international organizations, researchers, and as noted the media are not accurately evaluating the entire poaching narrative while trying to implement strategies to preserve rhino populations.

⁴³ Gao, Y. et al. (2016). Rhino horn trade in China: An analysis of the art and antiques market.

The newspaper analysis points out the arts and antiques market as an underestimated driver of the demand for rhino horns in China. In Chinese media, rhino horn consumption was reported to be driven by investment and collectible value 75% of the time, by artistic value 40%, of the time, and by medicinal value only 29% of the time. Additionally, their study showed a “significant positive correlation” between the volume of rhino horn auctioned in China, and the number of rhinoceroses being poached in South Africa, which has the largest rhino population in the world. Revealing the collectible and artistic value of rhino horns to be crucial in the conservation conversation. Rhino horns are utilized as a fine art carving material to make cups, bowls, hairpins, rings, and many other functional or ornamental items.⁴⁴ Those who have explored the markets in Vietnam or China looking for rhino horns, such as the journalists in the TV series *The Traffickers* (2016) were surprised to find it overwhelmingly in the form of ‘carvable’ or durable goods; this surprise is largely due to the misperception of rhino horns’ use.

The purpose of acquiring and consuming authentic rhino horns, increasingly seen in artistic forms, has shifted. What is now overwhelmingly driving the demand for rhino horns in China and Vietnam is the status or wealth symbol of owning the illegal horn. Tanya Sanerib, the senior attorney and international program legal director for the Center for Biological Diversity, explains how “the fact that its illegal, the fact that it’s from the wild, the fact that it’s hard to get and you have to have the resources to be able to have it” are major contributors to rhino horns current value.⁴⁵ Thorstein Veblen, in his classic work the *Theory of the Leisure Class* (1899) defined the terms positional goods and conspicuous consumption. These concepts are related to a society’s influence on economic decisions. Positional goods are items or services that often

⁴⁴ Ibid.

⁴⁵ Peters, Adele. (2018). Synthetic Rhino Horns are supposed to disrupt poaching. Will they work?

define what it means for members of a society to be wealthy, determined by whether they can attain them or not, and conspicuous consumption is the spending of money in order to attain utility by publicly displaying wealth or economic power. Veblen identifies the pursuit of owning positional goods or consuming conspicuously, as meeting the demand for ‘pecuniary reputability’ and being able to do so placed members of late 19th century in the wealthy, leisure class.⁴⁶ Authentic rhino horns now seem to be playing the role of a positional good within Vietnamese and Chinese cultures, and according to prophecies surrounding positional goods, there is a very grim future for global rhino populations. Veblen and other historical economists such as Max Hirsh proposed a prophecy surrounding positional goods, suggesting that even if the growth rate of the world’s population were to be zero, the earth’s non-renewable resources would ultimately be exhausted because of human being’s infinite pursuit of status attainment.⁴⁷

Wild rhino horns and their products becoming positional goods within Southeast Asian societies therefore predicts the decimation of global rhino populations as people pursue a wealth status. It is difficult to remove a good from the understanding of it as a positional good, and therefore decrease the demand for it. This was demonstrated by faux fur’s inability to attain the status of real fur products, and therefore displace the demand for real fur in many communities, including our fashion industry. Real fur was inherently preferred because of the status it held, and it took propaganda from animal rights advocates and conservation groups to eventually stigmatize the purchase of real fur products in the Western world. Furthermore, faux fur never resembled real fur enough to the point of them being indistinguishable in the way synthetic rhino horns being developed now could, and therefore would not act in the same way. The preference

⁴⁶ Veblen, Thorstein. (1899). *The Theory of the Leisure Class: An Economic Study of Institutions*.

⁴⁷ Schneider, M. (2007). *The Nature, History, and Significance of the Concept of Positional Goods*.

for real fur is similar to the expected preference for wild rhino horns, and conservation groups have stated that pursuing a similar route of decreasing the demand for rhino horn in Southeast Asian societies through education and propaganda are crucial to saving rhino populations. An indistinguishable, and inferior synthetic rhino horn, and the corresponding application of Akerlof's market for lemons may be able to serve as a successful conservation method by reducing the demand because of distrust. Given the understanding of rhino horn consumption as a means to a higher social status, a lemon would be effective in reducing the demand for horns by eliminating the utility derived from attaining them, because they are no longer considered to be a positional good.

The rarity of rhino horns, and the difficulty of attaining them, are the main contributors to its current status as a positional good. A synthetic rhino horn, or lemon, that legitimately creates distrust in the market for rhino horns would work to diminish these desired attributes and eradicate demand for real rhino horns. If a real rhino horn symbolizes a high status, a fake one may result in embarrassment or shame of purchasing a fake at the price of a real rhino horn. This is currently seen in our society; a consumer's purchase of a fake positional good, such as a 'knock – off' Louis Vuitton product, is met with ridicule. Real rhino horns being positional goods also highlights how Pembient's plan of an artificial rhino horn would not be more appealing to consumers, and therefore would not decrease poaching. The interplay between Akerlof's market for lemons, Veblen's positional goods lies, and rhino conservation lies in Dr. Vollrath and colleagues' potentially indistinguishable synthetic horn. If implemented as lemons, these synthetics would cause the collapse of the rhino horn market and eradicate the desire of a owning a rhino horn to achieve a high social status that is currently driving demand for wild rhino horns and poaching.

Conservation and Synthetic Rhino Horns

With the looming future of rhino populations, and failure of current conservation strategies, new methods must be implemented to preserve them. But the concerns of synthetic rhino horns must be fully addressed before their implementation as a preservation strategy takes place. The decreasing importance of medicinal beliefs lessens the worries of synthetics legitimizing these beliefs, and the assumption that they would be perceived as lesser than real rhino horns negates the possibility of increasing demand overall. So, the main concerns when utilizing an identical, inferior synthetic rhino horn are the problems in regulating rhino horn trade because of the confusing similarity under the microscope. As mentioned, conservation groups fear that a bio-fabricated or synthetic horn would facilitate real horn smuggling, because poaching syndicates could lie about the authenticity of their horn, claiming it to be synthetic when it is in fact authentic. However, the inability to distinguish them is the most important aspect of these horns in causing the market for rhino horn to collapse. This concern seems to stem from the understanding that synthetic rhino horns would be entering the market in a similar fashion as to wild rhino horns. This brings into question how the market for rhino horns would actually be flooded with lemons in order to create the necessary distrust. With limited information on the networking of rhino horns, and their disbursement through the black market, it is difficult to predict how the flooding of the rhino market would take place. This information, and therefore the realistic ability of synthetic rhino horns being a conservation method, should be further investigated and established before horns like Dr. Vollrath's are released.

Another concern of conservation groups is that the messaging behind synthetic rhino horns would make their efforts of decreasing demand for rhino horns through propaganda unclear. Patrick Bergin, CEO of the African Wildlife Foundation, stated that "If you start to

nuance that message with some rhino is good, some of its bad, some its legal, some of it is illegal, you lose people and lose the clarity of the message.”⁴⁸ However, this logic more applies to the synthetic rhino horns that would be marketed as artificial, and legal, like Pembient’s prototypes. Meanwhile, an identical, inferior substitute would not have messaging of being superior, or good, for contamination or environmental reasons, and rather would be more of a fear or distrust for consumers when buying a horn. Additionally, flooding the market for altruistic, rather than profit-based objectives, could potentially be done through groups such as Save the Rhino, which, depending on how the market is infiltrated, could allow for regulation issues to be avoided.

Conclusion

Despite concerns surrounding the current development of synthetic rhino horns from profit-based bio-tech companies, if implemented in the correct way, synthetic rhino horns could be an extremely effective conservation method. New ideas and strategies are necessary, and further exploration of this one seems to be becoming more important as rhino populations continue to decline at very alarming rates. An indistinguishable, identical, synthetic rhino horn that would serve as a lemon in the market for horns would cause the market to collapse and eliminate the horn’s status as a positional good. However, further information such as the realistic possibility of flooding the market with these synthetics and doing so in a way to avoid regulatory issues, is required before the conservation community is likely to get on board. Gambling with conservation methods for a species with very low numbers is dangerous, so the horns would need to be implemented in an extremely cautious and constructive manner. Yet,

⁴⁸ Actman, Jani. (2015) Can Fake Rhino Horn Stop the Poaching of a Species at Risk?

doing nothing to improve the current status and trend of rhino populations means we are likely to see this species go extinct. This exploration of relevant economic theories and models' responses synthetic rhino horns and their practical implications has lead to the conclusion that this conservation strategy should be considered further in light of the impending rhinoceros crisis.

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