

How the Regeneration of Biodiversity renders a Tea Plantation Competitive

The transformation of an organic tea estate in Assam (India) into an economic stronghold setting new standards for Park Management strengthening the community

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Kaziranga was accorded preliminary notification as Reserved Forest in 1905 and the Park was inscribed as a World Heritage Site since 1985 and celebrates more than 80 years of nature conservation. The population of rhinos, elephants and tigers has dramatically increased over time. The Hathikuli Organics, a tea plantation, created over a century ago decided in 2007 to turn the estate organic, in order cut to zero the drainage of chemicals into the Park. The challenge is how to turn the business into a profit, and how to cover the booming budget of the Park that increasingly diverts core resources from public and private institutions to fight poachers attracted by the largest population of Asian rhinos in the world.

Introduction

Assam counts 32 million inhabitants. It is located in the far North East of India, bordering China and Myanmar. It is here that the British colonizers established tea plantations over a century ago long before chemicals were used in agriculture, ensuring supply of tea to England when the opium wars cut supply from China. Assam produces 60% of all tea consumed in India. Here, under the leadership of the Tata Group, it was decided to convert a large tea farming region of 450 hectares into a 100% certified organic operation. The logic was simple and yet exemplary in the sector: the tea business, located on the foothills borders the Kaziranga National Park. How could one have a money spinning operation when the run-off cocktail of chemicals pollutes the Park and the Bhrmaputra river which runs alongside the park, which is one of the world's finest fish spawning areas feeding hundreds of millions downstream?

This is the region where Indian Government and Conservation NGOs have successfully demonstrated in cooperation with visionaries from the communities and the TATA Group that it is possible to regenerate the population of all fauna, including tigers, rhinos and elephants while finding a co-existence with a growing local population. The quest is now to design a competitive business model for agriculture and industry throughout the influence zone of the Kaziranga Park where the value generated sustains the extraordinary ecosystem services from biodiversity to soil fertility, generates jobs – the best antidote for poaching - and builds community.

Certified Organic

The immediate challenge faced by the Hathikuli organic tea estate is that productivity of these century old bushes dropped by more than half the moment no more chemicals

and synthetic fertilizers were applied. While the traditional tea experts blame the lack of synthetic fertilizers and pest controls, it is important to determine the origin of this dramatic downturn in output: the soil has been mined of carbon. When there is no carbon, there are no micro-organisms that nurture the roots, and less water is retained, increasing the need for irrigation.

There are two options, either one returns to creating a chemical lifeline for these old tea bushes, or one regenerates a vibrant natural environment for soil micro-organisms and insects replenishing the top soil with carbon and nutrients. The recreation of such natural environment requires first and foremost a replenishment of this thin layer of the Earth's skin with carbon. An analysis indicates that the carbon content on the farm has dropped to under 1%, while the local forests still have 6%, whereas the richest soils for farming known as *Terra preta* would have in excess of 30% carbon content. Intensive farming extracts carbon from the soil which implies that only a permanent additional supply of external energy from petrochemical resources can permit plants to maintain productivity.

This hard reality forces a critical analysis of the term "certified organic". This label, which has been applied with slightly different standards around the world basically tells the consumers what is "not" in the purchased product. That is to say: this tea or cotton has not been subjected to the application of synthetic pesticides, herbicides and/or fertilizers. However, this certificate does not say anything about the soil, nor the content of the food or clothing purchased! While the Tata Group actively pursued the organic label according to the definition of organics in the United States, Europe and Japan, each time submitting to an expensive certification process, it never occurred that this independent verification spells out nothing about the extraordinary context: protecting the largest rhino park in the world from run-off chemicals.

The second requirement is to re-introduce biodiversity. This is a challenge on a tea estate where management will follow the modern mantra of focus, limiting business to the core business, built around the core competence. However, when that singular activity is not generating the revenues and the margins required to sustain the business, then one must choose between the business imperative of cutting costs, increasing productivity and reducing labor, or, one opts for revenues from additional crops that can be quickly and effectively farmed and harvested using available resources. Whereas the traditionally trained Master of Business Administration would reject the idea of creating additional revenue streams, it may be the best way to generate cash and to replenish the soil, recuperating the much needed fertility.

Re-opening the Migration Corridor

The tea estate management went beyond the removal of the chemical burden from fauna and flora in the Park, it opened as the first in the world, a migration and escape corridor for mammals straight through its estate. The plains of the Brahmaputra River are part of a unique ecosystem that undergoes annual flooding. The dramatic rise of the water level cleanses this area of nearly 500 square kilometers of all debris, replenishes the top soil with silt containing a wealth of nutrients that washed down from the Himalayas, and ensures that next Spring there will be lush and high grasses providing an abundance of feed for rhinos, elephants, wild pigs, deer, hundreds of bird and plants species, creating such a supply of nutrition that predators such as tigers have plenty to

live off. However, during the flood season all animals have to migrate to the hills that surround the plains. As the human settlements rose from a few thousand when the park was established to 150,000, and the tea plantation turned denser while it expanded, the passage from the river basin to the highlands was obstructed which led to conflicts between humans and migrating animals.

The tea estate recognized that the only way to resolve the confrontation between wildlife and people and their tea farming business was to secure a safe passage for the animals. Hathikuli Organic donated a land corridor to the National Park that runs straight through the tea plantation. Wildlife is not keen on confrontation, and when a passage is offered, many animals search and find their way to the higher altitudes, on both sides of the river. This is the first plantation known that opens a migration route reducing the collision between people and fauna respecting the needs of animals to roam the land as they have done for millennia before the expansion of human settlements, and certainly prior to the establishment of a commercial plantation.

How to Combat Poaching while Making a Profit with Organics?

In 1823, Robert Bruce noticed the *Assamica* variety of tea growing wild in the hills of Rangpor during a trading mission. The farming of tea operates here under sub-optimal conditions compared to the Darjeeling region in India. The Assam winters are colder with temperatures dropping to 3 to 5 degree centigrade. The Himalayas are within sight. This results in an annual three to four month halt of tea leaf harvesting. Thus, during the winter season the factory for processing tea is closed, and while some maintenance is undertaken, it does affect staff employment. The Hathikuli Organic provides jobs to 850 full time workers, manages 550 homes on their premises, and relies on 1,500 temporary staff. Now, these temps are without work at least 5 months per year. That this period is when wildlife would be most at risk.

The tea estate is the largest employer in the area, eclipsing the National Park which has 1,200 people on their payroll. Stable and full-time jobs are key to ensure that the locals are not tempted to engage in poaching. The best way to guarantee that those who know the lay of the land best during day and night refuse to participate in poaching, is to have full employment in the region. The locals who are uniquely informed about the operations of the Park, and the movements of the rhinos, elephants and tigers, the animals that figure on the top of the list of the species to kill illegally should all have jobs. As long as there is unemployment, hunger and malnutrition, lack of health care, and no encouragement of local culture and traditions, including crafts, music and dance then there is a risk of locals seeking refuge in illegal businesses.

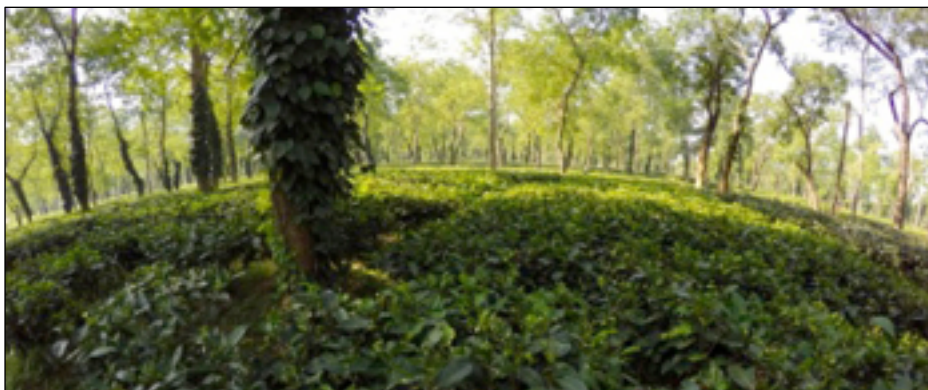
The day that I experienced the first elephant ride, herding rhinos through the plains of the Brahmaputra River, was the day that at the crack of the dawn a rhino was killed by poachers. While the perpetrators did not succeed in removing the horn, an irreparable damage was done by taking the life of a highly endangered animal. This deep penetration of the illegal hunters into the park confirmed that they had an extremely good knowledge of the area, and must at least have been advised by locals. This is one of the main reasons why the creation of permanent jobs must be a priority. However, the hard reality of the tea business is that by turning the plantation organic, and by turning over the corridor for migration, the business has been losing money. Under these conditions one cannot expect to increase the number of workers on the payroll.

On the contrary, there is pressure from the Board of Directors and the Shareholders that after years of intensive commitment to the environment, and the implementation of a social program that includes crèches and kindergarten for the employees' children, a social center for staff and a fully operating hospital 24/7 for everyone in the area, the Estate should return to profit. This is called "the business imperative".

The productivity of the tea bushes dropped by nearly 70 percent, while the processing capacity remained the same, increasing overhead cost. Just when all organic certifications were successfully obtained, an insect attack affects a third of the plantation. While in the past this attack by the *Helopeltis (Tea Mosquito)* would have been quickly controlled with a pesticide, that solution is now prohibited under the guidelines of organic certification. These pests require organic remediation. So employment increases while increasing cost and accumulating higher losses. It is against this background of doing good for the environment and for the local population that we must design a better revenue model that also replenishes the top soil and bring income diversity, while reducing risks. Unless Hathikuli turns profitable within a reasonable period of time, then the original intentions of finding a co-existence amongst fauna and flora of the park, human settlements with the culture and traditions, and the operation of business as a source of value generation evolves from a vision to a failure.

This cannot happen.

A Portfolio of Initiatives



Tea plantation with pepper vines growing on the shade providing tree ©2015, Pauli

The Amalgamated Plantations Pvt. Ltd. (APPL) that ultimately owns this unique experience, is committed to find a solution. The original logic of the team was to diversify the revenues of the plantation. This was not always welcomed by the traditional management that insisted on focusing and cutting costs. They attempted numerous crops but finally hit a bull's eye with the planting of pepper vines that populate the shade trees covering the plantation. Starting from an organic tea estate, the trees' canopy that covers the bushes offers a certified organic environment to farm organic pepper. That certificate has been obtained and the sales are contributing to the bottom line. A modest first step that we label "a diversification within the tea estate" using the ecosystem services of the tea plantation to generate more value. This is more efficient than replacing tea with another crop. APPL's intention that every single tree on the plantation should produce pepper. It makes sense. Pepper needs to be dried, the installation is available, thus capital costs are minimal.



Harvesting fish from the water retention ponds at Amalgamated Tea Plantations. ©2015, Pauli

A second initiative concerns water. The plantation requires irrigation. Over the years the estate relied on deep tube wells. As time went by, the managers noted a drop in the water table, an increased cost in pumping, and the realization that the local population is most likely also extracting water to satisfy their needs. This reduced the water tables of the park, affecting flora and fauna especially during the dry season. Thus, the decision was made to create 18 rainwater catchment ponds. This offered another opportunity: to farm fish. The executives of Hathikuli concluded after a few years of research that the organic farming of up to six types of carps using the traditional Chinese method that exploits each trophic level from grass feeding carps to bottom feeders was the way forward. Faced by the lack of local supply of strong and healthy brooders that provide the fingerlings, the farm operators decided to create their own breeding ponds. A first hand verification demonstrated a very healthy, diverse and thriving fish population. It is timely to point out that the Brahmaputra River is - after the Amazon Basin - the second largest fish brooding region of the world, and therefore a farming initiative could stimulate local fish protein, instead of the overfishing, acid or dynamite fishing that stresses the river resources today.

Go Beyond the Obvious

These two initiatives decided the direction of the transformation of this tea plantation: a business that uses what is locally available, does good for people, park and profit by generating more value. The question is how fast can this be implemented at a larger and broader scale? After sustaining millions of losses per year, one can only expect so much patience from the shareholders. Based on two decades of integrated fish farming, initially inspired by the pioneering work of Prof. George Chan from Mauritius, and Prof. Li Kangmin from China, we provided a blueprint of a vision that integrates all available resources and builds on the initial steps taken by the team of ATP.

The most important potential contribution is not the invention of a new technology, nor the development of another management concept. Rather, there is a need to connect all the activities and operations of the tea estate into a series of processes that include feedback loops that create multiplier effects using both the existing capital investments (CAPEX) and the daily operational costs (OPEX). There is a need to establish an

inventory of how costs can be turned into revenues, and stranded assets can produce more cash flow. The following pages are dedicated to outline what is possible, and provide the fundamentals to implement this portfolio of opportunities.



Visit to the Kaziranga Park accompanied by the Park Rangers. ©2015, Pauli

Starting with the Abundance of Pruning

The pruning of the tea bushes represents the first large volume of waste that is left underused on the farm. Its volume and weight is a multiple of the tea harvest. The management has stopped burning this debris and has resorted to composting. It is important to remind ourselves that tea bushes left to grow without control turn into tall hardwood trees. Thus, the pruning stunts the growth through a masterful clipping process and promotes the growth of fresh leaves, which are harvested and processed locally as tea. Since hardwood takes years to degrade, the return of this organic debris into soil nutrients is slow, and certainly does not contribute to the dire need to replenish the soil with carbon, nor does it generate more revenue or help to cut costs. The better option is to use the hundreds of tons of organic matter to farm mushrooms.

Mushrooms are not only an extraordinary degrader of wood, these devourers of lignocellulose produce fruiting bodies of commercial value. One ton of hardwood could generate as much as half a ton of shiitake mushrooms. Now if one were to time the bagging of the substrate based on pruning, and the vegetation of the mushrooms then one can plan to harvest at the same period that there is no tea harvesting and processing plant stands idle. This implies that the drying, grinding and bagging facilities shift operations from 7 months to a whole year. That contributes immediately to profit and to jobs. Part-time staff can now be full time, more versatile, better paid and involved in the development of the new business, that improves food quality and security.

In addition to the pruning, the park and its surroundings are suffering from pockets of infestations of water hyacinth. Research and practice in Africa have proven that this invasive fibrous perennial plant with seeds germinating over seven years is an ideal substrate for mushrooms as well. So, when the pruning has been exhausted, then the water hyacinths can supplement the supply of substrates creating a stable business with multiple sources of raw materials. It could even be converted into a year-round

business increasing the volume of processing at the factory and the revenues, also for the local population.

This would immediately turn the 4 months downtime now royally used to clean and maintain the plant, into a four month operation where exactly the same installation for drying, milling and packaging for tea is used for mushrooms. This would add at least \$1,000 per ton of processed mushrooms, which is more than the prevailing market price for tea. Since the amount of pruning is a multiple of the amount of tea leaves, these 4 months of operation could contribute a considerable amount to turnover and profit by spreading the overhead costs over a full year. While the numbers are still to be determined, it is not difficult to summarize on the "back of an envelope" the impact this expansion of the business has.

The preparation of the mushroom business could secure a broad-based citizen involvement as this is the case for the mushroom farming in China. The sheer volume of mushroom bags can reach thousands, even hundreds of thousands. These do not have to be kept at the factory. The central production unit would focus on the transformation of the pruning to "bricks" for inoculation with mycelium, that could be produced locally under strict hygienic conditions, as well in one of the existing laboratories of the estate. There is an opportunity to place the vegetative bags (when the mushroom is penetrating the substrate) in the homes of the local population, securing an involvement of the communities starting with the employees turning their spouses and children into partners. This turns the cultivation into a community effort. Since the revenues from mushroom farming are higher than the income generated by tea, one can be generous in setting the standard. There is an additional benefit: keeping mushrooms at home requires a strict application of hygienic standards which not only increase the productivity of the fruiting bodies, it will positively impact the health of the community members.

In a second phase of farming known as fruiting, the mushrooms need a caring environment during an extended period of harvesting. The process requires regular moisturizing, securing that the growth is spontaneous and the look and shape of the mushrooms are appealing. The large mushrooms, good for 10% of the market can be sold on the fresh market, the others can be processed in the factory, requiring a drying and blending. While mushrooms are not exactly the same as tea, a major part of the facility can be used for both. A trial run will quickly determine the exact configuration. From our experience we know that the safe way to grow the business is to involve communities of women who will have the "green hands" to turn this into a prolific farming activity. The production of thousands of tons of mushrooms could be processed in cooperation with the greatest culinary brands of the world like Noma from Denmark (for years recognized as the best restaurant in the world) into popular herbal and nutritional cubes containing a carefully selection variety of mushrooms, pepper from the local harvest and dozens of indigenous herbs that could also be farmed by the communities in order to offer a series of extraordinary blends. This process has been tested in Zimbabwe, with domesticated mushrooms farmed on agricultural waste, including coffee, and could be transposed to tea.

Are Mushrooms Competitive?



These mushrooms will be competitive on the market. First, because the raw material is fresh and local. Second, because there is a ready market for industrially produced organic mushrooms. Third, because there is readily available capital equipment that can be deployed at no additional investment cost, especially the source of energy which can ensure a sterilization that guarantees high productivity. While the business case will have to be made with more details, the logic can be explained based on comparable cases around the world. The social impact is immediate, and would generate the type of additional income into the tightly knitted families that offers the additional benefit of cohesion reducing the risk of diversion into poaching.

How to Replenish the Soil?

The question emerges: what about the compost and the need to replenish the earth with organic matter? A review of the health and strength of the soil discloses that this thin layer of soil has been mined to the limits. The carbon content is less than one percent. It is insufficient to merely apply compost. One of the best immediate sources of carbon and nitrogen is the spent substrate of the mushrooms. Ironically, the pruning that takes too long to degrade, is thanks to the mushrooms enriched with amino acids, and brings a wealth of carbon and nitrogen which has been extracted by the mushrooms from the air. This implies that the mushroom farming is not only a business on its own right, it is also a core element in the redressing of the fertility of the soil.

This soil needs an urgent replenishment of carbon and while the spent substrate is an excellent first step, more is needed to attain the levels of fertility that were known decades ago. A benchmark of 30 to 35 percent carbon content would be ideal. The recent science of *Terra preta*, the black earth, as was practiced by the Incas, the Native populations of the Amazon and the Vikings shows that a combination of organic matter with charcoal and excrements provides one of the richest soils with long term sustained fertility. The question is how can a tea plantation access and accumulate such a rich source of carbon over and above the mushrooms.

The strategy pursued in Brazil and elsewhere is the conversion of diapers, a modern-day nuisance that is highly practical and convenient, but costly to the environment, into *Terra preta*. If and when diapers are mainly produced from bamboo, with two simple sheets of bioplastics, laced with bamboo charcoal that is a balancing agent for the baby's skin, then this material can be converted into a carbon rich *Terra preta*. Since the local population reaches 150,000, there are an estimated 1,000 babies which could each produce one ton of *Terra preta* per year. This is one thousand tons of carbon rich material, while creating value for bamboo, abundant in the region, and creating additional jobs in the process. While this may not be sufficient for the plantation, it could become one of the contributing factors. While more will be needed in the design of a sustainable and profitable business for locally made diapers, this is how the Blue

Economy integrates into the local community, builds and intertwines multiple activities that stimulate the local economy since more cash is flowing through the pockets of the local communities with a powerful platform to create a strong premium brand for tea.

More to Get from the Fish Ponds

The fish ponds could contribute to replenish the soil with nutrients as well. If all 18 water retention dykes were converted to fish farms and operate all year then the intensive pluri-culture farming with only a limited number of bottom feeders would convert itself into one of the richest suppliers of fertilizers. After harvesting fish, the laying dry of the ponds in the winter would provide a nitrogen rich sludge at marginal cost, while sanitizing the ponds thanks to the exposure of the bottom to a few weeks of ultraviolet rays from the sun. If these fish were fed through a cycle that started with a digester, with its slurry further mineralized through algae ponds, then the feed stream into the ponds would include a rich mix of benthos, zooplankton and phytoplankton. This efficient cycling of nutrients allows the feeding of the feed of the fish. This reduces the cost of externally produced nutrition, increases to locally available cash.

However, one of the draw backs of the present set-up is that the winters in Assam can be cold, with temperatures dropping to 3-5 degree centigrade. While this is true, and this does affect fish farms, it is also true that the generation of hot air for the tea's (and mushrooms') drying process relies on three wood and coal fired stations. The exhaust from all three chimneys could be scrubbed for the SO_x and the NO_x, while the remaining warm air rich in CO₂ could be used to farm spirulina and heat the ponds. This would require the additional investment of approximately three kilometers of insulated hot water pipelines. Such an expenditure would push fish productivity up from the present 3.5 tons per hectare per year to at least 10 tons. This represents for the 18 ponds an annual production in the order of 200 tons of fish, a considerable addition to food security, based on healthy fish protein, generating an additional revenue for the tea plantation that goes beyond the tea, pepper and mushrooms. It could be stated that each ton produced on land, will save a ton of fish from the river. We are now clustering multiple cash flows around the available resources of the tea plantation ... and it is all organic. We would argue that this goes beyond organics! This goes way beyond the desire and the need to cut costs to survive.

From a Loss to Multiple Cash Flows

Now that the portfolio of commercial products has extended to four organic outputs, the tea estate is turning into more than a mere producer of tea. The operations generate multiple cash flows using existing resources, respond to basic needs of the farm - especially the generation of soil and the supply of abundant and rich water, the industrial processing generating value, the local community hungry for more and stable jobs, and the shareholders keen on turning a loss-making operation into one that can sustain itself.

Now all things considered, it is important to take this case beyond the traditional marketing of "organics". This tea plantation not only delivers quality products, it potentially contributes to society and the natural park in a way never seen before. It strengthens not only its own operations securing a future of the business itself, it increases the resilience of the communities while building an economy that grows without depleting resources and without endangering the delicate balance with the

thriving wildlife that borders the plantation. Actually, this business model regenerates the ecosystem, with a unique mindfulness and strengthens the resilience of the region. This tea plantation will turn into an important tourist destination complementing the park itself. This will further support sales, strengthen the brand which must exploit the marketing power that this story provides. This is an era of specialty teas that has no competition anywhere in the world. It must be explained as a pathway towards harmony among the communities, the fauna and flora of the Park's habitat and the business imperatives of a company.

Go Beyond the Tea and the Mushrooms

Of course this is only the beginning. There are many additional challenges to be faced and opportunities to be exploited. The development of organic herbicides and pesticides could become another pillar. This does go beyond the business of the Amalgamated Plantations. However, as a key customer for bio-chemicals that meet the strictest organic standards of the world, the Estate can kickstart a new industry. Since the TATA Chemicals group has decided to move from the traditional petrochemicals, and enter the market of nutraceuticals and biochemicals, there is an opportunity to create a synergy between the tea plantations and the chemical business. The number of potential products is vast, and we are only scratching the surface. Tests have demonstrated that elephants are very sensitive to *capsaicin*, which is the hot stuff from red chili. The hottest chilies in the world are farmed in Assam, this could be another option to explore. These bushes are easy to plant and could surround the tea plantation with an obvious effect on wild animals. It could be mixed with the mushrooms and other herbs to offer original mixes.



Products derived from post-industrial and post-consumer coffee waste

Let us further add that the chemistry of tea requires a more in-depth study. Over the past 20 years we partnered in the discovery of coffee chemistry. We first got the insights that coffee is an ideal substrate for mushrooms (post-harvest, post-industrial and post-consumer). Then we learned that the spent substrate after harvesting mushrooms is a competitive chicken feed, and an ideal soil enrichment. The coffee grounds are ideal odor controls in textiles, carpets and refrigerators while protecting paint from UV rays, extending its life, and serving at laboratory scale as an excellent absorption of hydrogen, competing with platinum in fuel cells. Is it possible that this tea/park initiative could be the platform for a broad tea chemistry initiative? I would hope so.

Tea chemistry is only taught to the experts of brewing tea. It is not taught to those who imagine the industries of the future in general and tea chemistry in particular. If Assam is to provide a livelihood beyond the delivery of cheap tea to 60% of the Indian population, then it must embark on the direction chosen by the TATA Group and the team at Amalgamated Plantations and take it way beyond what could ever have been imagined by the visionaries who created the park over a century ago and who started the tea estate in the same era.

This is only the beginning

The monies spent on the tea plantation throughout this whole process of organic conversion should not be considered losses, rather these are - at least - investments in corporate social responsibility (CSR). A group of the size and reputation of TATA, should not consider these initiatives as purely operational forcing this business to fit into the traditional supply chain management that aims to offer tea at a competitive low price to European customers. The strategy that is unfolding and the story that has not yet been told to the public at large, are clearly setting the stage for an extraordinary positioning of its corporate image ... beyond CSR. It is the beginning of a powerful specialty tea with a premium brand that has no competition anywhere in the world. This "Tea" symbolizes more than a drink in a global game of price, quality, profitability and market share.

The company has *-until today-* chosen not to share this extraordinary combination of the management of one of the world's richest and biodiverse ecosystems and the search for a profitable business model. This unfolding story has the right to be told and could be at the heart of a premium global brand as well as a thriving community and a resilient ecosystem. The Kaziranga National Park and World Heritage Site, as well as the tea growers of Assam certainly deserve a better avenue than the logic of cutting costs and streamlining operations when alternatives as described are not only viable, these are within reach based on proven track records elsewhere in the world.

This should benefit the business beyond the tea company, this rubs off on the new strategy for chemicals (since only biochemicals can be used) and the food produce business that could now enter a broader range of products, including the industrial cultivation and processing of mushrooms. If this is viable at the Hathikuli Organic estate, then business logic can be extended to the other 25 tea plantations the TATA Group controls. Then this effort can be transformed into a corporate business strategy. And that is a lesson the world would love to learn from!

For a brief video summarizing "The Challenge" described above please go to

https://www.youtube.com/watch?v=lwyWpRA_b5Y