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GUNTER PAULI
author of The Blue Economy

Plan A

The Transformation of Argentina´s Economy

JURRIAAN KAMP
editor

Preface by
RAB. SERGIO BERGMAN
Minister of Environment and Sustainable Development of the Republic of Argentina

System dynamics graphics: FRANÇOIS NOLET

Ministerio de Ambiente y Desarrollo Sustentable
Presidencia de la Nación

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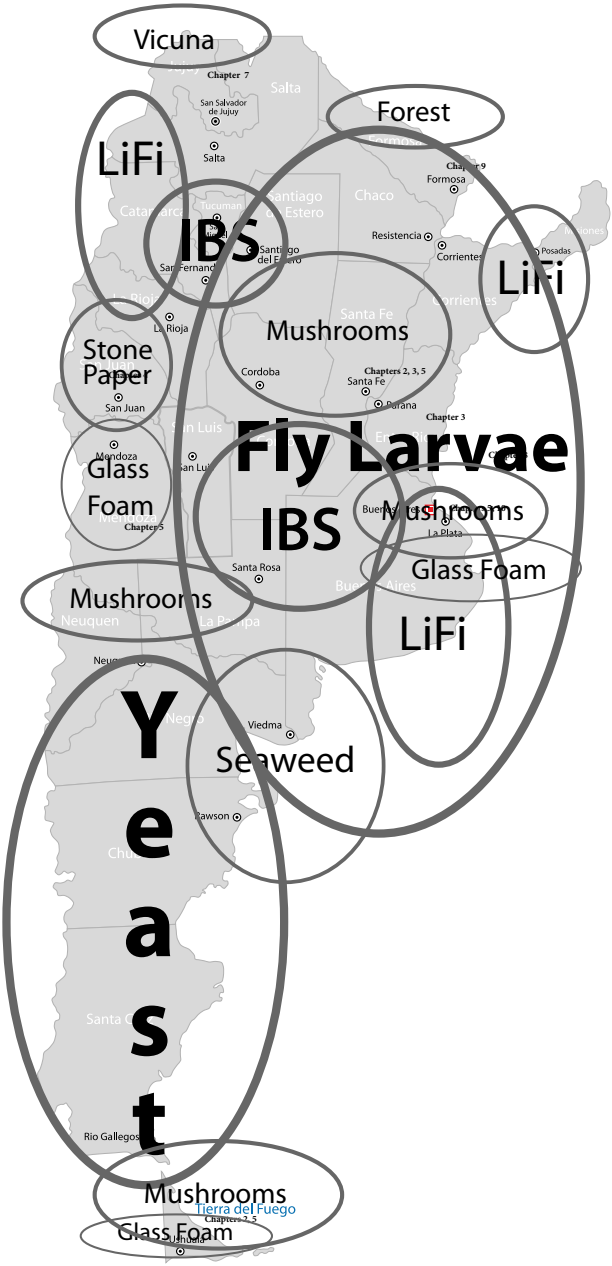
Argentinian Map of Opportunities



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Preface

Rab. Sergio Bergman
Minister of Environment and Sustainable Development of the Republic of Argentina

This book represents a proposal for cultural change towards sustainability and care of the environment in which we live. This is an initiative of the National Ministry of Environment and Sustainable Development for the transformation of the economy of Argentina: a comprehensive vision in which the whole exceeds the sum of the parts. Fundamentally, it proposes the development of production activities that add value and generate progress without affecting the environment, thus fulfilling the duty to ensure that future generations have the same rights as we have to enjoy a healthy environment.

This strategic document develops a vision that embodies concrete aspirations. It is the result of a year of collaborative and proactive work aimed at transmuting a new paradigm into actions. Hundreds of voices have participated in its elaboration. It represents the most diverse social sectors, including governmental actors, investment agencies, business leaders, academics, technical institutes, civil society organizations, students and citizens in general. We have sought to open dialogue, build bridges, articulate views and ensure that projects were transformed into tangible realities.

The content of this volume is aligned with the Sustainable Development Goals (SDGs) of the United Nations: a universal call for action to end poverty, protect the planet, and guarantee peace and prosperity for all people. If the projects in this book are implemented, it will enable us to go beyond the SDGs.

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I have stated on several occasions, "Nothing should be profitable if it is not sustainable". In accordance with this, the subject is here approached from an economic perspective that shares the principles of the Blue Economy developed by the Belgian entrepreneur— and author of this book— Gunter Pauli. This is a holistic and innovative concept in the business approach: to produce the goods and services that citizens need to be content, by emulating natural ecosystems, assuming shared responsibility and respecting the rights of future generations. The Blue Economy strives to optimize the performance of our current resources and infrastructure, and, chiefly, to harness waste as raw material and stranded assets as infrastructure for creating new products.

A ministry that does not get involved in discussions to establish the new rules of the game of market and economy will turn its activity into mere anecdotal actions. The Ministry of Environment and Sustainable Development is the adequate body to ensure the continuous, tenable existence of all Argentines. As its name implies, its mission is to take care of the environment – not in isolation, but as an essential factor for sustainable development.

The following pages offer an overview of several opportunities for sustainable economic ventures with high development potential in the country. Everything is well founded on scientific and technological bases, and in the analysis of business models adapted to the traits of the Argentine territory. An example of this is Stone Paper, which would enable the manufacturing of paper without using any trees or water. Or the generation of internet by means of light, which would result in energy savings of 80%, or the production of energy through the cultivation of algae on floating platforms in the ocean.

Argentina is a fertile field for enterprises that promote economic development, create employment and wealth, and, at the same time, result in improvement and tangible solutions for environmental problems. Many of these opportunities require only the use of idle resources— currently ignored or yet unknown— and the deployment

of low investment. Some, however, demand technological advances of greater complexity and cost. But, in all cases, implementation would allow vast improvement from traditional models of exploitation in strategic sectors such as energy and food, among others. These are areas of activity that currently suffer limitations due to their environmental impacts or their limited added value to society. From this point of view, I am pleased to propose an economy that does not encourage the bolstering of effectiveness at the expense of ethics.

Beyond the diversity of the proposals, all of them respond to a systemic view which promotes the sustainable territorial development of the communities where they are implemented. In some cases, they even constitute a tool to regenerate degraded areas.

It is the conviction of the President of the Nation, Mauricio Macri, that these initiatives be carried out by the private sector. In line with that definition, this publication is essentially an invitation, a call. Interdisciplinary, inter-jurisdictional and inter-ministerial work will be necessary for this to happen. The mission of the Nation is, undoubtedly, to favor the conditions that promote, facilitate and smooth this path of constructive dialogue and transformation. And this is the commitment we assume.

I am convinced of the transcendence of the projects proposed here. Their common denominator is clear: to change the way we think about our relationship with Nature, in order to treat all forms of life with respect and responsibility. The future is not what is going to happen, but what we do to make it happen.

Rab. Sergio Bergman
Minister of Environment and Sustainable
Development of the Nation

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Executive Summary

Argentina has a great potential to launch at least 10 new economic activities to transform her economy. Each one of these opportunities is based on available resources. These include: raw materials that are locally accessible in abundance, an existing infrastructure for transportation and processing, and a proven demand on the market. Investors are ready to engage. Science confirms the proposed opportunities for groundbreaking economic transformation.

This transformation is possible, the know how is sufficiently widespread, and where the skills may be lacking, the desire to learn and act has been noted. The international financing community is alert. When the right policy framework will accompany these proposals, the passage from concept to implementation can be swiftly pursued.

Some of these innovative business models may surprise policymakers, entrepreneurs and investors. However, each one has been tested as relevant in the particular circumstances. The first objective of this portfolio of activities is to offer policymakers and investors options to outperform what is on offer today. Argentina has the opportunity to transform an economy based on commodities and big scale industrial processes to an economy based on value added products that is capable of responding to the basic needs of all. This transformation will also ensure a competitive position for Argentina because it is built on the unique assets of the country.

This outline—Plan A—is but a first one, but it sets a clear mark and it will contribute to the rebuilding the brand of Argentina with initiatives that inspire both the social activist, the environmental pioneer, the new-found entrepreneur and the impact investor.

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Acknowledgements and a Word about the Methodology

This book is the distillate of a year of work. We involved hundreds of people, undertook dozens of travels, visited the four corners of Argentina, shared our insights with thousands, and addressed diverse audiences from students, and unemployed, to farmers, and chambers of commerce, indigenous communities and artists, industrialists, journalists, academia and the government. The extraordinary team from the Cabinet of the Minister of Environment and Sustainable Development, lead by the Minister Rabino Sergio Bergman has been instrumental in ensuring that this process was efficient and far-reaching.

The group of support from the Argentinian chapter of the Club of Rome and an inspiring circle of leaders and change-makers—Daniel Van Lierde, Gustavo Grobocopatel, Darío Werthein, Javier Gronda, Elisa Parodi, Mauro Toscani, Alberto Hensel, Raúl Tello, Omar Perotti, Luis Castellano, María Inés Zigaran, and Kris Tompkins—have been a tremendous support. I am indebted to them.

The identification of the opportunities we present in this book underwent a rigorous process. First, when ideas emerged we defined if there is the underpinning science. Once the international scientific community provides an unequivocal support, then we solicited a signal of

interest from the entrepreneurial community and the world of investors. Armed with these three feedbacks, we model the impact of the proposal on the region.

This process was coordinated by a team that has been guided and coached for years by Charles van der Haegen and Yusuke Saraya from the ZERI coordination centers in Brussels and Tokyo.

Then there is a need to undertake the first-hand tests from the business innovators themselves. Several came in person to Argentina and offered us a resounding confirmation that these opportunities are solid and ready for execution. The visits of Henry Liang (stone paper) and Joost Wouters (seaweed to gas), Anderson Sakuma (integrated biosystems), Chido Govera (mushroom farming), Sybilla Sorondo Myelzwynska, Argentine designer based in Spain (vicuña), Charlie Papazian, founder of the Association of Craft Brewers in the United States (yeast) and Carlos Bernal (regeneration of native forests) offered what was needed: a hands-on confirmation that this is real.

The Blue Economy works with available resources, and searches to have impact in the territory. We need to map this impact, on the resilience of the community, generating jobs and strengthening resilience while responding to their basic needs, on the environment, putting nature back on its evolutionary and symbiotic path, and on the business which needs to compete solidly and effectively by generating value. This is framed and mastered through a mathematical modeling process known as "system dynamics".

This exercise was coordinated by François Nolet, a graduate in business from ICHEC Business School in Brussels, Belgium who took this opportunity to share his modeling skills as a crash course in designing development. He has learned a lot in the process, and succeeded in teaching all of us how vast the implications are.

Subsequently, we need to submit the whole effort to an acid test: will investors agree that these are opportunities can create a legacy? Mariana Bozesan and Tom Schulz, the proprietors of AQAL Capital facilitated

with the European Business Angels Network (EBAN), a platform that permitted us to test the ground before some 200 family offices. The results were more than encouraging. They deserve our gratitude for putting Argentina and these innovative business models on the map.

A special word of thanks to Professor Lucio Brusch de Fraga and Professor Carlos Bernal Quintero, the founder president of ZERI Brasil Foundation and ZERI Latin America (based in Bogota) for their personal involvement alongside everyone else ensuring that the high ethical and methodological standards accompany the hard work style and the content that I am sure will surprise many.

Finally, we translated all core concepts into fables. Our proposals are often dismissed as fantasy. However, we forget that our present production and consumption model lives in a world of fantasy: we consume more than the carrying capacity of our ecosystems. That is why we present the zest of the innovations in layman's language to inspire everyone to consider this "fantasy" as a reality.

This book would not have been possible without the personal commitment of the editor, Jurriaan Kamp. He lost a few sleepless nights over this project but finished it in time in spite of the tight deadlines.

This book would never have been available in a record time for its presentation in Buenos Aires without the production team for the English and Spanish edition headed by Fernando Cabrera, Raquel Fratta, Julien Laurençon and Nico Biebel. There is no doubt that this passionate team was not going to let this opportunity to inspire to go by. Since this was a rush job any errors that are still left in this first edition are of course the full responsibility of the author.

With deep gratitude to all.

The ZERI Team

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Foreword

When I wrote in 1991 the first article on the need to embrace the concept of zero waste and zero emissions, little did I realize that everyone criticized me for being unscientific (did I not know of the second law of thermodynamics) and unrealistic (did I not understand it would cost too much and therefore make the business uncompetitive).

Only a year later, I welcomed 500 guests to the inauguration of the first zero emissions factory, a wooden structure that had its own waste water treatment, capturing its organic volatiles onto the grass roof and where everything solid was to be recycled. I bought for my workers Patagonia underwear, knowing that the high cost would be largely compensated by the reduced cost of energy on the shop floor. There were only seven parking places in front of the building since I paid staff to cycle to work. Building parking is expensive. Riding to work is healthy. I knew that if we would put our minds to it, we could do it. We could even enjoy it, save money and get healthy while offering great returns. It is great for the planet as well.

The Japanese management principles inspired me: zero accidents should be the goal at the shop floor, and total quality equaled zero defects. Would the concept of zero emissions and zero waste not be the logical extension? While I saw this clearly before me, apparently no one else did. As a global citizen on a mission to change the world for the better, I concluded that there was no point in debating any further, the only way to convince was to expose those who were and are prepared to see what we have done. While the projects were small, my factory did not even have 100 employees, the

joy was great when supermarkets were pressed by customers to put my detergents on the shelves.

When we harvested the mushrooms on coffee, and fed the first spent substrate to a chicken we sensed victory. The first initiatives in Fiji, Colombia and Namibia, soon expanded and diversified and, before I knew it, the natural dynamics of the good created this portfolio of the most diverse ideas that with the most surprising partners resulted in the most diverse initiatives with tangible results.

As time evolved, and all these initiatives evolved, I realized that I was not just realizing a dream, I was going beyond my dreams. I was not only inspiring people to dream again, I was empowering them to stop being negative and against, and join this drive to change the rules of the game, create a new competitive industry, to respond to people's needs and strengthen the commons. This gives a sense of maturity in life, and an energy that characterizes everyone in our broad network of scientists, scholars, entrepreneurs and educators.

As we started designing projects transforming tiny first steps into transformations like Gaviotas (regenerating a forest) and El Hierro (relaunching the economy of a depopulating island), we experienced that the demand was great, and the pull was strong. Would I see opportunities beyond coffee and tea, islands and the sea? Travels to more than 150 countries and a relentless rhythm of discovery, envisioning and embracing new realities left me with a sense of enthusiasm that tends to be contagious. I am not capable of not seeing the good, even in the wake of the worst like a dilapidated gold mine in Ghana, a desertification in Mongolia, or a closed down petrochemical plant with asbestos in Italy.

The first projects impacted a few families (Tsumeb Brewery in Namibia), a school (Montfort Boys Town in Fiji), a community (Las Gaviotas in Colombia), an island (El Hierro in Spain), a province (Limburg in Belgium), an agricultural zone (Eje Cafetero in Colombia), a coffee company (Lavazza), a pasta maker (Barilla), a region (Brittany in France), an industry (biopolymers in Italy and gold mining in Ghana and Colombia), and then the scope started extending to mega-cities

(Johannesburg in South Africa), nations (Argentina) and sub-continents (11 island states in the South Pacific).

Demand for our creative input of how to transform unknown assets into new portfolios of industries is rapidly on the rise and the only limiting factor is our own creative capacity to respond. There is a clear willingness to design new business model and economic growth scenarios that go beyond the proposals but that build on the desire to move from idea to reality, from concept to implementation. This report is the distillation of the first and most relevant findings in Argentina, a project at the request of the highest authorities of the Nation. It is not our job to define new strategies for Argentina. We wish to contribute to the objective that the government has stated: the transformation to a more competitive nation that is better able to respond to the basic needs of all, including the millions of living creatures that are part of an ecosystem.

The size and the scope, the speed and the scale that policy makers, investors, business leaders, and pioneers from NGOs are ready to embrace permits us to see for the first time this window of opportunity that can have impact on statistics. There is no doubt, we need to start impacting but that willingness has never been so great. It is important that we clarify that the team of ZERI and the Blue Economy, are not the wonder boys and girls that make magic happen. We sensed the trends, which are finally articulated and these permit us to surf the waves and create a difference first of all because we subject every out of the box idea to the scientists and ensure that there is a minimum of truth in each statement. We only observe what there is, and imagine—on the basis of science—what there could be. Once this has been obtained then I wish to ascertain that whatever we propose makes business and societal sense for the *Captains of Legacy*. Armed with this, we are ready to change the world, one step at the time, but ready to run faster and longer than ever before because we know we can do better and more.

What an honor to have been asked by the President of Argentina to reflect on the future of this great nation I first visited in 1976. I have always been convinced that it has a greater future then realized to date,

and after one year of intensive work with my 150 colleagues who guided and inspired, provided science and sense I am convinced that this is a nation that can shift from scarcity to abundance, from unemployment to full employment, from chemistry and genetics to putting the grand ecosystems and Nature back on its evolutionary path. There is no doubt in my mind, that Argentina can turn into a competitive force with an economic model that is based on what it has, generating value and satisfying the needs of all. What a privilege to join this endeavor. I started this mission with passion, I will continue it with pride.

Gunter Pauli

Introduction

An opportunity for 'Captains of Legacy'

This book is about the *transformation* of Argentina's economy. Transformation: "A seemingly miraculous change in form", reads the dictionary. Argentina seeks fundamental change. It wants to build an economy that serves the needs of its people. Those needs include a healthy and sustainable environment and the urgent generation of jobs to reverse the impoverishment that characterized more than a decade of crises. That means that it is not Argentina's objective to catch up on industrial policies that have produced widespread pollution and waste in other countries. Argentina doesn't want more of the same. The present political and business leadership looks for innovations and breakthroughs that achieve bold goals. It wants to lead and to inspire—her own citizens and the wider world. It wants a miracle, indeed. But, as we shall see, such a miracle can be achieved. In fact, Argentina cannot fail if the country is prepared to embrace creative insights offered by science and experience, and follow the laws that have been creating abundance in nature since the beginnings of time.

In the late 1800s Argentina was a "go to" place. The country showed great progress and—from a European perspective—more potential than Brazil, Mexico and even the United States. Buenos Aires developed as the Paris of Latin America with wide avenues and gorgeous buildings. Argentina's soil seemed richer and more productive than anywhere else fed by an abundance

of water. Argentina's wealthy future as a rich nation seemed secure. Many ventured across the Atlantic Ocean to come to the new land of bonanza and work for a decade or two and then return home rich.

Some 125 years later, Argentina had lost its historic excellence after decades of political and economic upheaval but it still possesses vast natural wealth and resources as the 8th largest country in the world spread out over almost 3 million square kilometers and with access to 3.3 million square kilometers of territorial seas which double the economic potential for the nation as we will see throughout this book. The country is divided in 18 eco-regions with incredible biological diversity and fertility. Under a new government, Argentina seeks new élan to shine once again. The country has the potential. It now needs the boldness as well as the clarity of vision to act.

The Government of President Mauricio Macri (2016-2020) realizes that a transformation of the economy requires more than fresh investments to "update" existing industries. It is more than a reset or a catch-up. The World Bank states that Argentina is "currently undergoing an economic transformation that promotes sustainable economic development with social inclusion and integration in the global economy". Yet, Argentina is still listed as a "developing nation". That term seems to imply that a country is somewhere halfway on a journey that would earn it the status of "developed" at some undefined finish line.

It is a misleading and misguided trajectory that is easily illustrated with two figures. Today, the average Argentinean produces 341 kilograms of waste per year whereas the average American produces 733 kilograms. Surely, Argentina's goal can't be to follow the American journey of "progress" only to increase the waste in its society. True wealth requires more than the wasteful, polluting economic "development" as we know it. In fact, as we shall see in this book, true wealth can be acquired without disproportionate financial investments while simply using, and thus cleaning up, waste and idle resources—by adding value to things that have no value today. Quality of life cannot solely be created by restrictive policies that constrain industry to pursue its goals, there is a need to expose

the established industries as well as the entrepreneurs to a portfolio of opportunities that will outcompete the present. This is the main goal of this report called Plan A, where A stands for Argentina. We do not believe that there is a Plan B: Argentina has to focus on what it can achieve with the available resources.

The resilient and productive economies of the future will succeed in following the inspiration of nature. The challenge of our modern society is that most of our economy—from farming to industry, from banking to the Internet— ignores nature, even works *against* nature. Our societies and systems—in many ways deliberately—defy the basic laws that underpin the functioning of our world. We do not grasp the incredible chances to respond to people's needs for water, food, health, housing, energy and jobs converting readily available resources and infrastructure into products and services that are produced and consumed within the carrying capacity.

Our level of ignorance is sometimes surprising. We spend massive amounts of energy to overcome gravity—from elevators to water-distribution systems and air-conditioning—and yet we never bother to watch an apple grow. This is not a romantic reflection, this is a scientific observation: Why are we taught only how the apple comes down from the tree according to the law of gravity, and why has no one bothered explaining to us another series of seven laws of physics that allow an apple to first defy the law of gravity prior to subjecting itself to it? As long as we look only at the law of gravity, how can we even imagine the most energy-efficient techniques?

This Plan A proposes to explain how "Argentinian apples" get up in the tree and serve society while achieving levels of efficiency that many consider "impossible to reach". Exactly. If one only uses the technologies and the business models of today, the proposals in this book have no chance at all. But if we are prepared to go beyond reason, innovate with positive disruptions then there will be a rapid transformation of the economy. Plan A sets the stage for surprising competitive proposals that will unsettle present understanding. Each proposition is substantiated by science and by concrete cases from around the world. And we know that

the only response to incredulity is to suggest a visit to the place where these businesses have been implemented, and to witness the new realities that have been created. The brief descriptions in this book are backed up science and research in detailed reports totalling over 2,000 pages compiled under our direction by the Argentinian Chapter of the Club of Rome, and which are available at request at the Ministry of Environment and Sustainable Development.

Following natural principles means leaving centuries of linear thinking behind and embracing a systems approach to evolution and change. It poses a challenge for us to see and accept the potential for transformation in non-linear ways, cascading matter, nutrition and energy like ecosystems cycle. You cannot "plan" a rainforest. But once you get a rainforest going, change is deeper, more fundamental and more rewarding than anything that could have been achieved with old-fashioned planning (see chapter 9).

Nature has overcome nearly every imaginable challenge over the past millions of years. We should follow the time-tested design principles that nature uses to produce food, cycle water, regenerate soil, and ensure that *all* members of the ecosystem succeed on their evolutionary and symbiotic paths. Nature has an incredibly efficient business model. There's no waste in nature, no pollution, and no unemployment. Nature is never concerned about its "core business" or about "economies of scale." Nature respects limits. A tree "knows" that if it gets to 100 feet tall, there's no point in going to 500 feet. In nature, there's collaboration—symbiosis— in addition to evolution to respond to everyone's needs in the whole system. In nature, we can discover how to turn that 90-plus percent waste that our economies generate into new value, transforming scarcity into abundance, unemployment into jobs, hunger into healthy diets. In fact, in the process, we can restore much damage done, put nature back on its evolutionary path, generate tens of thousands of jobs and rebuild communities.

A systems approach means that we look across the boundaries of existing industries to discover new benefits. When we cultivate seaweed to produce biogas, we are not only replacing fossil fuels, we are also producing fertilizer and animal feed, and we are regenerating marine environments that help

re-establish fish stocks. When we introduce manufacturing stone paper as a model to clean up the waste of the mining industry, we are also battling deforestation, soil depletion and climate change. The 10 business models for Argentina in this book each provide multiple benefits—for society, for entrepreneurs and for investors. Multiple benefits mean multiple cash flows. And that means more flexibility, less risk and more resilience… just like nature.

In these examples and models, a government cannot lead with a traditional "department structure". Ministers have to work together across department lines because "seaweed" belongs to the department of energy as much as to the department of fisheries and even health and agriculture. This requires as much innovation and dedication at the level of the state, as it requires clarity amongst entrepreneurs and investors that the common denominator is a redefinition of competitiveness. All stakeholders need to jointly discover how and where Argentina benefits most in terms of value generated in the economy.

The models in this book require minimal investments and provide short or mid-term payback terms. A mushroom farm (chapter 2) can be started with 500 dollars and that money can be recouped in two weeks. A seaweed farm can be started with 25,000 dollars per hectare and that investment comes back in three years, while accumulating sufficient cash flow to self-finance growth which can evolve into a multi-billion dollar initiative. A small fly larvae factory can be started with 50,000 dollars and that money can be earned back in one year. A foam glass plant needs an investment of 2 million dollars and that investment can be recouped in 5 years. The manufacturing of stone paper needs the biggest investment with more than 100 million dollars per mill but even that investment can be earned back in some 3 to 5 years. And each of projects—from the small to the large—offer returns in excess of 20 percent.

Yes, all these models provide swift and healthy returns. But this is about more than money. Remember, this is about the transformation of the Argentinean economy and society. It is about regenerating damaged ecosystems and (re) building healthy communities. It is about showing the world how a truly

vibrant society develops. It is about launching a wave of creativity and entrepreneurship that radiates confidence in the future for new generations.

That is why we need a force to harness this creative energy. The message of history is clear: there is no more powerful force to drive innovation and change than human enterprise. Decades of well-funded non-profit initiatives dedicated to solving humanity's most-pressing problems—from malaria to malnutrition—have alleviated the worst but have not changed the world. And, yes, governments can have a big impact and facilitate and support outcomes for the common good through regulation and tax policies. However, as we have witnessed with the action required to reverse climate change, the policy makers are not capable of taking the bold decisions that are required and turn statistics around.

In the end only enterprising pioneers and their "angel" investors can lead fundamental innovation and transformation. Without entrepreneurial drive and capital to support it, we will only witness more of the same. Plan A is not just a plan for transformation, it is also an investment strategy. There is a good reason for that. No initiative can ever sustain social and environmental goals over time unless it is assured of a continuous flow of revenue, and the building up of capital. If critical social and environmental initiatives depend on subsidies or charity, they are at risk and will likely face disruptions.

However, we face a challenge. As we have seen, business—as we know it today—has become a force that only serves a few at the expense of many and the environment that all life depends on. The highest entrepreneurial achievements today are initiatives—like Facebook and Uber—that create billions for a few people out of services that do not respond to the most basic needs of citizens around the world. In the past, steel and railway barons also became extremely wealthy but their contributions were arguably much more related to common interests and needs.

We have even invented a new category of business to describe activities that support society at large. We talk about "responsible business" and about "social entrepreneurs". These are great initiatives but, like the nonprofits, they haven't had a major impact on changing the overall negative and

destructive course that business is on in today's world. Moreover, "responsible business" and "social entrepreneurs" sound like "organic apples". In the strange world we are living in, it has become normal to treat natural fruit like apples with all kinds of artificial, and unhealthy, substances to "protect" it against insects, et cetera. And, as a result, there are also people growing natural apples that we call "organic apples". We have given a new name to something that was always there: an apple that falls from a tree is, well… an apple. Shouldn't we instead have given that new treated apple its own name—a *chemical* apple?

Similarly, there is only one objective for business: to provide products and services to serve the interests of society and to create value for society. That's why corporations receive a license to operate. Instead of calling businesses that serve the common good "responsible" or "social", we should call the degenerated version of modern business today "irresponsible" or "destructive" business. There is power in words. They help us understand what we are doing.

It is not that long ago that business and society were still on parallel paths. In fact, the world has radically changed in a mere two generations as the following anecdote illustrates. Some twenty years ago, the son of Frits Philips—the then almost 100-year old former CEO of the multinational electronics company of that name, and son of its founder, Anton Philips—was watching the evening news with his father. The news was about Philips closing factories in Asia and laying off employees and the report concluded that the share price of the company had risen after the announcements. Father Philips reacted shocked that the managing director of a Philips factory spoke about its closure without so much as a word about the pain and sadness of the people who were going to lose their jobs. Then Philips senior continued, lecturing his son: "Why do you think that we opened a factory in Drachten [a town in the poorer northern part of the Netherlands, far away from the Philips headquarters in the south of the country] after the World War II? Of course, that was inconvenient for us, but that was where people needed work."

In other words, only a few decades ago, Philips still knew it carried an economic and social responsibility in and for society. And, some ten years

ago, Ratan Tata, then chairman of India's largest industrial conglomerate, the Tata Group—that is almost completely owned by philanthropic trusts—said after the acquisition of the British-Dutch steel company Corus: "We earn money to give it away. I want to go to bed every night knowing that I haven't hurt anyone". These are very rare words spoken by an entrepreneur these days.

We may have to wait a long time before the mainstream world of government and business, redesigns the rules of the business game so that the corporate world will serve society again. It also clear that business as usual will not solve humanity's problems. So, we have work to do. There are massive opportunities for transformation in the interest of billions of people. So, rather that depending on "captains of industry" who nowadays only seem to pray to the gods of greed and money, we need nourish the emergence of *The Captains of Legacy* (Please note: these captains, entrepreneurs and investors, are women and men but we will—respectfully to both sexes—write about them in the masculine sense). You hardly create a meaningful legacy when you develop a computer program, make a few billions which you then give away to good causes. Captains of legacy don't make money in the old way to then give it back the right way. Captains of legacy give their best creative energy to transforming the world toward a better society, working in harmony with nature, dedicated to doing much better all the time. While doing so over time they will make money, and their children and grandchildren may even make a lot of money, and there is nothing wrong with that. However, their first priority is always meeting the needs of society—alleviating poverty, generating jobs, restoring nature.

Let's be careful with the word "legacy". The legacy doesn't have to be one great invention—a battery that can be made without non-renewable metals—or one big industry. A legacy can be an idea, an approach that leads to transformation—mushroom farming—that can be copied by millions around the globe. A new generation of millennials is making clear on a daily basis that they stand ready to contribute in a different way than their parents. They are natural members of the new tribe of captains

of legacy. To get them going—as well as anyone who wants to contribute to putting communities and nature back on their evolutionary paths—we first need to identify portfolios of opportunities with locally available resources.

Yvon Chouinard of outdoor gear manufacturer Patagonia, arguably one of the most successful sustainable enterprise, never went to college and started his company to provide climbing gear for his friends so that he himself would have money to go rock climbing as well. Chouinard responded to a need… The fundamental flaw is this: we cannot subject and limit entrepreneurship to managerial techniques that created the industries that dominate today. Entrepreneurship is in the first place about identifying and responding to needs. That requires an ability to get out of the box and navigate unchartered environments. And, it does *not* require a market study to define needs. You only need to open your eyes to determine whether there is a need for jobs, clean water or healthy food, and to conclude that what has been done, so far, has not changed the needs. That is the purpose of our scan of Argentina and our search for identifying chances others have not seen.

Once, a captain of legacy has identified needs, his next assignment is to look beyond the obvious. That's why he doesn't need a clever book by an expert on how to generate clean drinking water in 10 simple steps… If there was an obvious solution, it would have been implemented by now. The mission is to take a fresh look at what is locally available. An entrepreneur needs to create value in response to needs while using what is readily available. He imagines solutions embodied in products and services that no one visualized before. Apple's Steve Jobs was a master of this process to design something everyone wants and nobody realized they were missing.

For the captain of legacy abundance of readily available resources, including labor, in the local environment is a critical starting point. That is how we approached the task entrusted to us by the Argentinean government. We can always spot the necessary abundance. Abundance of resources allows for a competitive proposition and a disruptive approach

to the market. We need that because we want to fast track innovation to respond to the pressing challenges of poverty, hunger or loss of species that cannot afford patience or an investment "burn rate" where lots of money is spent before any tangible results are achieved. All proposals of the Plan A have a break-even point calculated as net-accumulated cash flow of less than 5 years.

While the entrepreneur should not exercise patience in the response to basic needs, he should avoid rushing to producing or designing one product or service right away. Rather, the challenge is to oversee the system that any product or service is part of. It is impossible to know and understand the complexity of the system from the start. For the same reason—and counter to traditional, old-fashioned business models that are taught at MBA schools—the goal is not to have one product—sold to customers. Rather, the objective is to have an interactive platform of customers that will create an integrated portfolio of products and services that will ultimately transform society.

That also means that it is of great importance to keep discovering and exploring continuously. Plan A contains an initial review of 10 most relevant initiatives. Its aim is to create and inspire a culture of innovation. Nature keeps evolving, responding and filling new niches. The hardest thing for an entrepreneur—indeed for any human being—is to always keep a beginner's mind. The current project may very well be only the small stepping stone to a next step that is bigger and more impactful than you can imagine today. But you can only find that next bigger opportunity when you are not too fixated on what you have at hand. Over time—when understanding of natural processes grows—the system-platform approach to enterprise will become a second nature. The platform—or the community—also reduces risks and that's another important condition for the resilience and ongoing success of the enterprise.

When the need is clear and great, and the abundant local resources have been identified, the captain of legacy can launch a portfolio of solutions—his business model—quickly and without any need for substantial (financial) investments. He just needs to make sure that he knows who

his first customers are. Each of the proposals points towards the resources that are abundant, and the clients in waiting. The farming of mushrooms provides a good example (see chapter 2). Imagine that a group of orphans starts farming mushrooms and wishes to sell to local restaurants and stores. That will be a high-risk venture that won't easily attract interest or investment. The orphans have no business experience. Why would any restaurant buy their mushrooms? If, on the other hand, the orphans begin with collecting spent coffee grounds from the restaurants, they will find support and collaboration because they solve a problem: they collect waste. If they subsequently turn that waste into mushrooms, the restaurants will be interested because the orphans have added value to "their" waste. In other words: the first paying customers can easily and clearly be identified, and that gets the business going.

In the current business paradigm of perceived scarcity, protection is key. Innovations are hidden in patents. At best, a new successful concept is distributed through a franchise model. There are some 37,000 McDonalds outlets in the world that serve 68 million people every day. It took 70 years to build the company to what it is today. It may seem impressive. However, there are +800 million people suffering from malnutrition worldwide. The McDonalds model—irrespective of the quality of the fast food—is clearly not going to solve that problem anytime soon. That is why innovative business models, open source principles and sharing insights on how to succeed is vital.

Mushroom farming works everywhere, although the opportunities will be different according to local circumstances. When the experiences are freely shared, the opportunity can spread very fast. Chido Govera began farming mushrooms in 1997. Twenty years later, there are some 5,000 mushrooms projects, rebuilding local communities, around the world. If we take that to one million, a lot of people can earn a good living. To get there, there is no need for a boardroom, a market analysis and an investment plan that gravely slow growth any development, constrain action and block creativity. With transparency mushroom farming can indeed feed hundreds of millions of people and make a serious contribution to the

malnutrition challenge. And, remember, our true reality is abundance. There is no limited cake that forces to fight for the biggest piece; there is ever-growing cake of new opportunities that keep adding multiple benefits to more and more people. That is what the captain of legacy wants to achieve. This is what we envision for Argentina.

The opportunities are endless. Mushroom farmers will discover that their customer-restaurant not only have spent coffee grounds after serving their clients. They also serve them fresh orange juice, and—at the end of the day—they have container full or orange peels. Why doesn't the farmer collect these as well? One kilogram of citrus peels, one liter of water and seven spoons of sugar in a glass container will be enough to produce—within a few weeks without any need for energy—one liter of fresh orange smelling soap that can be used as dishwashing liquid, hand soap, shampoo and floor cleaner. Some transformations can turn it into an effective toilet and bathroom cleaner. Do you think the restaurant would be interested in sharing this local soap with its clients in the bathrooms?

As we will see in chapter 2, there's much more you can do with coffee grounds. When you build an integrated open source platform of producers and consumers, there will be a continuous weaving of opportunities. That leads to a key characteristic of the captain of legacy: he has self-imposed an ongoing responsibility to generate value. When the next, bigger opportunity arises, he has to act and accept the challenge.

Our world does not make enough progress in responding to urgent, basic needs, because great projects and opportunities are not pursued because we are ignorant about them. Our greatest obstacle in economic growth is the fact that we copy what the world does, and ignore what a new world is inventing. It is a moral duty to ensure that more value is created so that more needs can be served and that we build on the pioneering cases that are relevant. This is an important task of this Plan A. Given the tasks, the challenges reach beyond generations. It took 40 years to restore the rainforest in Las Gaviotas to the level it has achieved today. It may take even longer to replant mangroves to protect coastal zones and to establish seaweed plantations around the world. But is time a problem?

Many travelers are inspired when they visit the medieval cathedrals spread around the countries of Europe. Most of these cathedrals were built over more than a century. This means that the visionary leaders that were determined to endow their city with a cathedral would never see the final work of art and architecture, and they knew it. And, the carpenters and sculptors knew that they were not going to enjoy the finished result of their work during their lifetime. Still, everyone believed in the project and were inspired and motivated to contribute their money and talents for a few generations to come. That is the role and the responsibility of the captain of legacy. This is what we imagine for Argentina with this simple and short Plan A.

After decades of destruction, the rebuilding of communities and the restoration of nature will be like building cathedrals. We need captains of legacy, entrepreneurs and investors, who—like the cathedral carpenters—believe that you can change the course and transform society, and the planet. This book shows that many cathedrals are waiting to be built in Argentina and around the world while some are already under construction. And this is an invitation for captains of legacy in Argentina and beyond to join this rewarding and inspiring journey of transformation.

Fable 1

Masters and grandmasters

The captains of legacy invest time and money in endeavors that will change the direction of a community. This requires a unique environment to learn. Since innovations are not known, and the new business models are yet to turn mainstream the pedagogy required to create this fundamental shift implies that the masters learn from their students. This is a precious lesson from Asia.

Two students are worrying about their exams. Their tough professor proposed that those who could ask him a question about their subject field that he cannot answer properly will get full marks in the exam.

"I think this is a trick," says the one student.

"No, it's not! It's a way to challenge us to learn better and more," replies the other student.

"But why?"

"Because if we want to ask him a question he has no clue about, we must first know everything he knows."

"That means to get full marks, we must be as smart as he is.

Forget it! We'd better learn everything he'd taught us by heart."

"This professor is different. I guarantee you. That's why he is considered a master – a true sensei."

"Imagine you are a master and every year you have hundreds of new students coming to show you that they have learned something from you. Better they show that they have been inspired."

"Then the master will be inspired."

"And imagine that each year there area a few students who bring new ideas, new theories, new cases. What happens to the master: he will be learning from his students by teaching the best he knows!"

"They say that the best masters have students who will be better than they ever were."

"That is the only way there will be innovation, progress, creativity. It is so much needed to make a better world."

"Imagine all we would do is learn what our parents and teachers know, and nothing more. No progress."

"Yes but since the master has many students, he is learning a lot - while the students will only learn from the master."

"That is how our professor can become the Grand Master."

"And this is how students become new Masters"

"If the Grand Master learns from the best students, who turn Masters, some of whom one day may also be Grand Masters, and shares everything he knows and learns, then he could even become immortal and be remembered forever."

... *And it only has just begun*!

Plan A

Argentinian Map of Opportunities

PART A
The Protein Strategy

The Opportunity
"Fly Larvae"

US$ 3 billion
150,000 jobs

Argentina has the resources to produce 1.5 million tons of additional animal protein valued at US$2,000 per ton, while cutting waste from slaughterhouses and reduce pressure on commercial fishing.

Australia has decided to opt for this competitive initiative in partnership with AgriProtein (South Africa) where the proof of concept has been implemented.

Plan A

Chapter 1

Increasing protein production with fly larvae

Argentina produces protein for 400 million people. That's a remarkable achievement for a nation of 44 million people. Even more remarkable is that Argentina can do substantially better while improving marine and land environments. Using fly larvae Argentina can convert waste of the meat production into fresh protein that can be fed to poultry and fish. Only using waste Argentina can increase its protein output with more than 30 percent. This new activity generates new economic development, income and jobs. In the process Argentina cleans up its own environment, reduces deforestation and the pressure on scarce water resources while supporting the regeneration of fish stock, yet another source of protein. Contrary to common understanding, the generation of more protein can actually clean-up the environment. This innovative approach is tested at scale, has attracted major investments and is in the process of a global roll-out. Argentina can join and even lead this bandwagon.

Current global meat consumption is about 320 million tons per year. Including the fish catch of 93 million tons and fish cultivation of 74 million tons, total animal protein consumption reaches almost 500 million tons. While meat consumption in western countries is decreasing through the adoption of healthier diets, rising standards of living in the rest of the world are leading to people eating more and more meat. Global animal protein consumption is expected to rise to 700 million tons in

2050. Today, there are 19 billion chickens, 1.5 billion cows, 1 billion pigs, 1 billion sheep living on the planet and a trillion fingerlings in fish farms. All these animals need to be fed.

These numbers indicate the enormous demand for animal feed: Globally, 98 percent of soybeans, 34 percent of all grain production and 33 percent of the fish catch is used to feed animals. The race to feed is in the end a race to produce more protein. High quality protein is converted into a higher sales value at a high conversion cost. The increasing grain and soybean production depletes soil and water resources, and increases deforestation. Feeding fish with fish generates pressure on marine environments. As a result, 75 percent of the world's fish stocks are in dangerous decline.

There is simply no way to keep feeding more and more animals beyond the carrying capacity of the earth without seriously damaging natural environments. Therefore, we need a radical innovation. In order to secure a solid response to demand, one needs to get out of the box, and beyond the beaten tracks. This opens the way for innovation and the creation of new industries. High-tech solutions include the cultivation of meat cells in reactors without the presence of an animal ever. IndieBio is a biotech accelerator that backs startups that aim to completely redefine food production, reducing the environmental impact and ending cruelty to animals. "The aim is to ensure that people keep eating what they love, but to produce it in a way so it's not damaging the planet," says IndieBio's co-founder, Ryan Bethencourt, who is vegan.

Memphis Meats is a IndieBio success. The company generated headlines last year with the creation of the world's first lab-grown meatball. The company has subsequently succeeded in making "clean" chicken and duck (without needing to raise and kill the animals for their meat). Its CEO Uma Valeti says the process involves taking tiny meat cells from an animal (via a painless biopsy or sample). These are then fed nutrients, which enables the cells to grow, and they eventually turn into edible meat. The environmental impact of reducing the world's cattle herds, which are major emitters of methane, would be profound. "If the US switched

to Memphis Meats beef, we would expect the greenhouse gas reduction to be like taking almost 23m cars off the road. One burger could save the amount of water used in 51 showers," Valeti says. A recent survey suggests that 65 percent of people in the United States would give "in-vitro" or "cultured meat" a try.

A country like Argentina that has such vast extensions of land does not have a competitive position in this hi-tech, hi-capital game. Its territories and resources are ideal for innovations that embrace lo-tech and low-capital. That is the solution of producing protein through cultivating insects. Most people cringe at the thought of eating insects despite the fact that over 1,000 species of insects are known to be eaten in 80 percent of the world's nations. If the exception were to become the rule, then we would eat 60 percent of our protein from insects only. However, animals—chicken, trout, salmon—are used to eating insects. In fact, fishermen use insects as bait to catch fish, and no one has minded that.

Studies show that fly larvae have a high nutritional value and are a reliable source of food. Fly larvae can have protein levels of 60 percent without any genetic manipulation or gene printing, compared to 35 percent for soy bean flour. That means that there's an enormous opportunity to relieve the pressure on growing protein for animal feed by shifting to the cultivation of insects. The best part of this solution is that waste is the only thing we need for the cultivation of insects. Argentina that processes both animals in slaughterhouses and grains in mills, is therefore strategically ideally positioned to embark on this highly productive process, with solid returns and convincing environmental credentials.

In other words: we can grow much more protein with a free resource Argentina already has in abundance. The immediate focus would be on the waste of slaughter houses, and the leftovers of restaurants and supermarkets that today often seriously pollutes water systems and overburden landfills. The combination of both industrial scale waste streams in a rural environment, and the reduction of the food waste in an urban environment offer investment opportunities that benefit from a guaranteed supply (the waste) and a guaranteed demand (protein).

Plan A

Common flies (*Musca domestica*) and "black soldier fly" (*Hermetia illucens*) can quickly transform biological waste. The abundance of nutrients in these streams of waste stimulates flies to generate eggs quickly. A fly egg farm produces the trillions of eggs required to start the process. When the eggs hatch—a process that takes 3 days—they produce larvae that are rich in protein. However, this high concentration of protein requires an abundant source of nutrients, which is transformed and sanitized, and that is the most critical component of the process. The digestive track of larvae provides a shift in acidity that does not permit any bacteria or viruses to survive. In the right circumstances, the fly larvae mature in 10 days. In another 5 days, a new generation of flies is born that live for some 3 weeks while they concentrate on mating and finding a suitable place to lay their eggs. This is under ideal circumstances no more than 18 days for the full cycle. One has to time the process carefully, otherwise swarms of flies will control an environment.

Biologically, insects are the most efficient animals. They need 2 kilograms of food to generate 1 kilogram of insect body weight. Cows require, for example, at least 8 kilograms of feed to produce 1 kilogram of weight gain. From the breaking of the egg, flies can increase their weight 200 times in only 10 days. Even the chicken with an selected obesity gene and a superfood diet cannot match this performance. Insects are so efficient in converting food because they are cold-blooded species and have an exceptional digestive system. They acquire all the energy required to regulate their body temperature.

Here's what the productivity of fly larvae means in the context of Argentina. The country slaughters 10 million cows annually for meat production. The average weight of a cow is 1,000 kilograms. After-slaughter waste is about 50 percent or 500 kilograms. That means that the meat processing industry produces 10 million cows x 500 kilograms = 5 million tons of waste every year. Insects can convert this waste into 2.5 million ton of larvae body weight of which 60 percent—1.5 million ton—is protein.

There are of course alternative uses for this pile of fat, blood, brains and

lungs. Today much of that waste is converted into pet food. However even though dog and cat food are sold at premium prices, the income is not very attractive as the costs for taste and odor enhancers to make pets eat what most humans do not eat are high. The quest for competitiveness relies these days not on "being the cheapest" rather on "the capability to generate most value." It is within this context that Argentina has an exceptional opportunity to build a new industry.

Today, Argentina produces an estimated 7.3 million ton of protein per year. Only the conversion of the existing waste streams of the meat industry through the conversion of offal at the abattoirs adds 20 percent to that total. Of course, Argentina has much more organic waste than the blood and brains from meat processing that can be converted. Combining various sources of organic waste, including vegetable sources, even increases the nutritional value of the larvae.

The larvae catch a premium price since they have a higher amount of healthy Omega-3 fatty acids comparable to that of fish. They are also rich in fiber and micronutrients such as copper, iron, magnesium, phosphorus, manganese, selenium, calcium, zinc, and vitamins A, B_2, and C.

The larvae could be sold alive as a quality feed for fish and poultry or they can be dehydrated to create a consistent substitute for fishmeal. Feeding insects to the local poultry requires a tight supply chain management since a delay of delivery with a few hours could cause an annoying fly problem. However, the fresh supply has the additional advantage that the larvae contain 50 percent water. That means chicken that today get dry feed to save on transportation costs, will require large amounts of drinking water. That solves one of the major health challenges for chicken farms as the chicken pollute their own drinking water with their feces. That problem has led to the need to add antibiotics to control the cycle of diseases which terrifies the sector.

The impact on the global scale is tremendous. Each ton of larvae can replace a ton of fish only caught to feed other fish. For example: salmon devour 3 kilograms of sardines or anchovies to produce one kilogram of their popular orange flesh. That means that larvae production can relieve

the pressure on South America as the biggest producer of anchovies in the world. That pressure is reflected in recent sharp increases of the price of fishmeal which has risen from 1,000 to 1,500 and 2,000 dollars per ton.

Fly larvae can replace 25 to 100 percent of the soy and fishmeal that is currently fed to animals. That fact has a huge potential environmental impact. The world market for animal feed is about 1 billion tons with a value of 400 billion dollars. 80 percent of that market—800 million tons—is served with soybeans. To produce that amount of soy a landmass of almost 2.5 million square kilometers is needed. That's about the size of Argentina and four times the size of France. The production of soybeans also requires 1,700 trillion liters of water every year. That's enough to provide 59 (!) billion people a daily requirement of 80 liters per person 365 days a year. In other words: the conversion of existing waste by larvae can solve drinking water challenges in the world as well. Argentina is increasingly suffering from water shortages as well, and this strategic option allows to pursue a systemic approach.

However, there's more demand for fly larvae. They are superior "sanitization machines" converting waste that's very vulnerable to bacterial attacks. In the first place, that's very helpful to clean up the pollution caused by the waste generated by slaughter houses. The same quality makes the saliva of very specific larvae an effective treatment for wounds in hospitals that are dealing with an increasing ineffectiveness of antibiotics. In the past twenty years, reviving an ancient tradition, larvae are increasingly being used to treat diabetic lesions to reduce the risk of amputation. Diabetes, and other complex wound applications offers a vast market. The United States spent 20 billion dollars on diabetic wound treatment in 2013. There are currently 29 million Americans with diabetes and, by some estimates, one in three Americans will suffer from this disease in 2050.

Furthermore, it's possible to extract oils and lipids from the larvae which can be used in the cosmetics industry. Finally, the remains of the food left by the larvae can be used as fertilizer. All these opportunities are known, documented and proven as a business model.

Given the massive potential of fly larvae especially in nations with a rich agriculture, it does not surprise that, following recommendations of the FAO, the European Union decided in 2015 to incorporate insects as a new source of protein into the food chain of animals and humans. One of the leaders in this new emerging field is AgriProtein from South Africa. With support from the Australian government, this company is setting up 20 fly farms that will convert 1.8 million tons of organic waste with an army of 8.5 billion flies for an annual output 5,000 tons larvae feed, 2,000 tons maggot oil and a leftover that provides high-value compost. In another example of the beneficial impact of larvae production, AgriProtein is also assisting local communities in South Africa that lack sewage systems to treat human waste through larvae based systems. This approach creates a sewage service that pays for itself.

It is easy to forecast that in the next 10 years there are lucrative opportunities for some 500 production companies like AgroProtein in the world. These factories could have a combined output of between 1,000 and 5,000 tons a day generating—at 2,000 dollars a ton—between 2 and 10 million dollars in revenue every day and between 100,000 and 150,000 jobs.

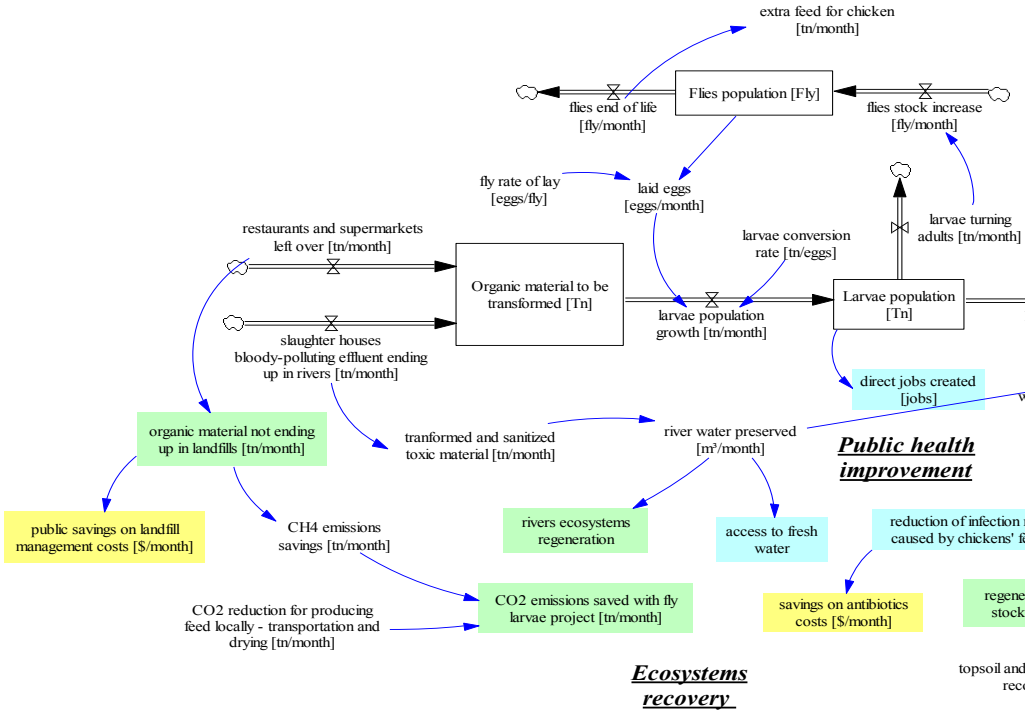
There is a huge potential and Argentina is well-positioned to become an early leader in this lucrative field. To begin with the country has some 650 slaughter houses and many that currently are a source of substantial environmental pollution. Blood spills into rivers causing unhealthy levels of phosphorous and nitrogen. Larvae production cleanes up this mess while providing attractive additional income to a not so lucrative—meat processing—industry. The waste of a small slaughter house can generate up to 375 kilos of larvae per week—or 20 tons a year—with one kilo of fly eggs. That would mean an additional income of 40,000 dollars a year. Depending on the processing capacity, a larvae production plant, that should be built close to the meat processing facility to save transportation costs, requires an investment between 4 and 12 million dollars. The investment is lower when the plant only produces live larvae; an installation to create dry feed adds to the cost.

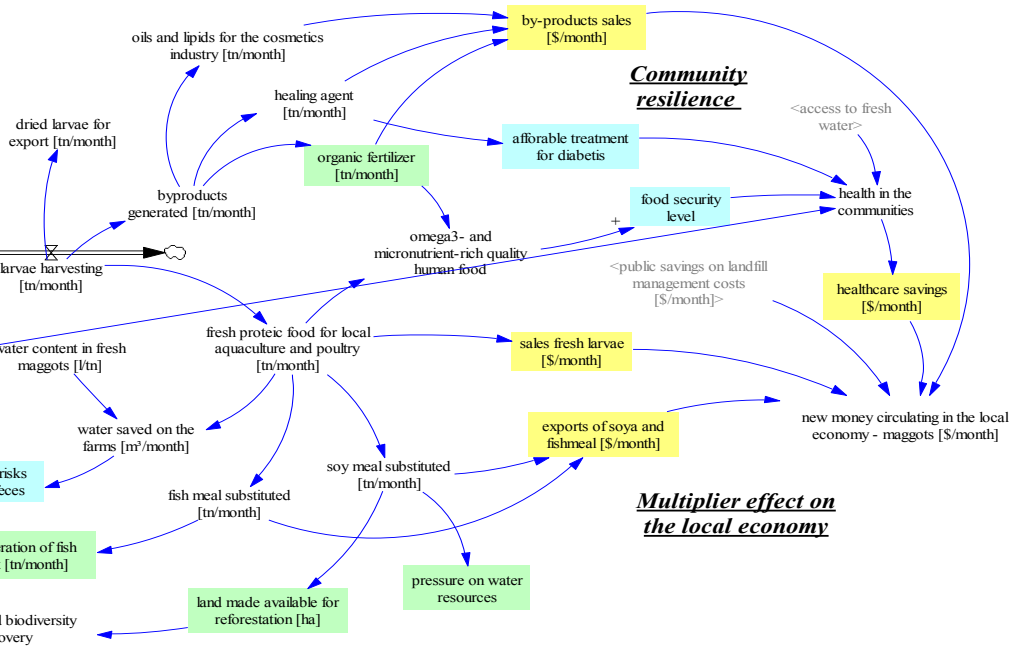
Plan A

The development of the cultivation of larvae does not require much land space. It reduces pollution and saves precious resources. Apart from an initial investment, the raw material is free. Whenever the operating expenses are low, a strategic shift is setting the direction of the market, changing the rules of the game. Cultivating larvae generates a genuine economic development and creates new jobs within a sustainable environmental framework. It is the kind of initiative that every government is looking for.

Plan A

Clustering slaughter houses with feed




by-products sales [$/month]
oils and lipids for the cosmetics industry [tn/month]
Community resilience
healing agent [tn/month]
<access to fresh water>
dried larvae for export [tn/month]
afforable treatment for diabetis
organic fertilizer [tn/month]
byproducts generated [tn/month]
food security level
health in the communities
omega3- and micronutrient-rich quality human food
+
larvae harvesting [tn/month]
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sales fresh larvae [$/month]
water saved on the farms [m³/month]
exports of soya and fishmeal [$/month]
new money circulating in the local economy - maggots [$/month]
risks ecces
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Multiplier effect on the local economy
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pressure on water resources
land made available for reforestation [ha]
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Fable 2

Maggot spit

The power of flies is their unparalleled productivity. However, as with all the proposals for investment inspired by the Blue Economy, there is more to it than a simple improvement in output. The transformation of biological waste, from plant to animal protein to a product with a higher value is only the beginning of a process that takes the project beyond expectations. The fact that slaughterhouse waste, which all too often contaminates rivers and endangers public health can be converted to protein on an industrial scale is a breakthrough, but the extraction of saliva that permits the control of diabetic ulcers and other complex wounds, takes the business to a new level, serving society with what is available.

A covey of quails is foraging around in an area infested with flies.

"We are having one of the greatest luncheons ever," giggles one quail.

"Indeed, it is so strange that people simply don't like flies."

"Well, whatever people do not understand, they don't like. Flies are like food factories."

"Yes, for us that is true, but people could never imagine eating maggots."

"Well, they do like our tiny and super-nutritious eggs. But when they see maggots crawling in waste, they pull up their noses and even shut their eyes."

"Oh, these chubby maggots are simply the tastiest I have had in a long time. We better hurry or they will turn into flies. And to be honest, flies simply are not as tasty."

"I agree, but there is nothing on earth that makes protein faster than these tiny fly eggs once they turn into maggots. Can you imagine, providing they have enough food, one kilogram of fly eggs turns into more than 300 kilograms of wonderful, protein-rich food within just three days!"

"No one can do better, I believe not even algae, mushrooms or bacteria match this performance! Did you know these maggots have very special saliva?"

"What is so special about their spit?"

"It helps heal wounds."

"Really? How does that work?"

"Well, it helps cells to grow while it cleans the wound of dead tissue."

"That sounds great, but would you like maggots crawling all over your body?"

"Perhaps, if I had no other choice. If a wound does not heal, the doctor may have to amputate; that means losing a foot or a limb."

"Why don't they milk the spit?"

"Hmmm, extracting spit – now that sounds like a challenge."

"Hey, what happens to you when your head goes under water when you are at the beach?"

"Nothing. I take care to close my beak and breathe out through my nose."

"But if a big wave surprises you, turns you upside down and you gulp a lot of salt water, then what?"

"Ugh! You know I will throw up."

"That's what I thought. So let us put the maggots in salt water and then skim their spit. It may not sound appetising, but it will certainly provide relief for people with open wounds."

"You are right, people should realise that time alone does not heal all wounds, and that a maggot can certainly offer some help."

... *And it only has just begun*!

The Opportunity
"Mushrooms"

US$ 9 billion
600,000 jobs

Argentina has the resources to produce 9 million tons of additional protein valued at US$1,000 per ton, while converting agricultural wase into jobs and nutrition.

Over 5,000 farms have been established around the world, in the North and in the South. A US$500 initial investment converts into a small scale business with reference from around the globe.

Plan A

Chapter 2

Re-energizing the local economy with mushrooms

Governments want to serve the needs of their citizens. They want to provide economic and social opportunities. They want to support public health. All these objectives require healthy local economies that provide local jobs. Stimulating local economies begins with focusing on the basic—local—needs of people: water, food, housing, health, energy, and education.

Many people in the world are desperately looking for ways to make some money. And many people think that you need money and resources to make money. So, they feel frustrated, powerless, and caught in a vicious circle while they look at the government for support. They don't see the wealth potential in the environment around them. However, there are always accessible, local, and available resources—even when nothing seems available. This is the key: discover what you have and what it is useful for. The best solutions to local problems emerge in local opportunities, and with that, a sense of empowerment and the strengthening of the belief that the community has the capacity to progress.

As we know Argentina is a major producer of food in the world. People in many countries benefit from Argentina's extraordinary efforts on a daily basis. However, the success of the country in many ways fails to reach everyone in the local communities.

Argentina has a major opportunity to address this painful reality in an efficient, very low-cost way using something that the country has in abundance: biomass. Argentina can follow the example of an inspiring story that started some 20 years ago and that since has been replicated many times around the world changing the lives of thousands of people. It's also a story that Argentine coffee drinkers will love.

At age 11, Chido Govera was an orphan in rural Zimbabwe. She never knew her father, and her mother died from AIDS when she was seven. Chido took care of her blind grandmother and her younger brother—trying to find food and water—while she was physically abused by members of her extended family. A relative suggested she marry a 50-year-old man to escape her life of poverty and abuse. The 11-year-old chose a different path and went to the local church. There she was introduced to a project developed by Zero Emissions Research and Initiatives (ZERI), a global network of scientists and entrepreneurs seeking solutions to problems of the world. ZERI had developed a method inspired by Professor Shuting Chang, a scientist based at the Chinese University in Hong Kong, who is credited with farming innovation in China, to cultivate mushrooms on grass clippings, coffee grounds, corn cobs, and water hyacinth—resources, "waste," that are within everyone's reach. ZERI scientists had discovered that 100 pounds of water hyacinths could produce as much as 240 pounds of tropical mushrooms. Some mushroom varieties contain about 25 percent of the protein found in meat and all essential amino-acids needed by human beings, giving them a high nutritional value.

The logic of the project in Zimbabwe was straightforward: A first flush of mushrooms could be harvested within a few weeks, and this would provide food and nutrition security and income for orphaned girls who would subsequently be able to refuse abuse. Chido was among 15 girls between the ages of 11 and 14 selected by the church to learn how to take their future in their own hands. The results were amazing, and the transformation of the girls was dramatic. In just a few weeks they matured with smiles on their faces. A simple biological process had led to fundamental social transformation.

Twenty years later there are an estimated 5,000 mushroom businesses in the world. These are not just small businesses that lift people out of poverty. Setas, inspired by this opportunity, is a large mushroom farm in Colombia that annually generates 17 million dollars growing mushrooms on the waste generated from coffee and sugar cane production. Two college graduates from the Haas School of Business at Berkeley University, Alejandro Velez and Nikhil Arora, started a mushroom business in the San Francisco Bay Area in 2007. Today their company, *Back to the Roots*, has grown into a business with 50 employees. It works in the North, it works in the South.

If all coffee waste, from the leftovers of farms to the grounds from cafes around the world, was used to farm mushrooms, the world could produce an additional 16 million tons of food and animal feed per year. This is only coffee! It would not require the use of any additional land and, we would only *use what we already have today*. Organic waste, biomass from agriculture, rich in fibers, should never be left to rot or even used for compost. Although composting is good, it does not generate real jobs. Apart from the lost income opportunities, rotting generates methane gas, a greenhouse gas that is 21 times more harmful than CO_2.

Argentina generates an estimated 18 million tons of plant waste every year. On average 50 percent of that biomass can be converted into mushrooms. That is 9 million tons of mush- rooms with a market value of 1,000 dollars per ton. That is a potential value of 9 billion dollars per year—income that can be created simply by using what Argentina as a major food producer has in abundance.

A potential annual production of 9 million tons of mushrooms per year also means 200 kilograms of mushrooms per Argentinian per year. The average world citizen eats 4 kilograms of mushrooms per year with Hong Kong leading the global consumption with 14 kilograms per person per year. So, 200 kilograms per Argentinian goes beyond the country's needs. However, the point is that a simple addition to the Argentina's agricultural production would easily solve the country's malnutrition challenges as

mushrooms provide a full range of essential amino acids, the essential building blocks of life.

But the Argentinians are carnivores? They love meat. They are not going to eat mushrooms—we are told over and over again. That may be true. It's definitely true that worldwide there's health trend towards a more plant-based diet. Mushrooms can and will play a major role in that trend. Not just as fresh produce but also as the ingredient for veggie burgers, sauces, soups, broths, etc. On top of that, mushrooms provide good feed for animals. The substrate used for farming mushrooms has been digested by the enzymes of the fungi and they have enriched it with more amino acids, turning something that was not edible into something desirable for animals.

Mushroom cultivation can guide Argentina to meet domestic nutrition challenges. It also adds a new dimension to Argentina's export portfolio as one of the top 10 global food producers. Mushrooms are a rapidly growing market: between 1997 and 2012 global consumption grew with 400 percent illustrating changing diet patterns, even amongst the most ardent carnivores of the world. Annual growth worldwide continues in double digits and the current world market value of traded edible mushrooms is 25 billion dollars. Based on the biomass that Argentina currently produces, the country has the opportunity to capture more than 30 percent of the world market.

How to do that?

Mushroom cultivation is very different from major crops like soy and corn. It's much more labor-intensive. There is a major difference in cash flow generation. If you plant soy, you need to prepare the land, turn the soil nude of competing plants, then you plant and you can only harvest three months later. Mushrooms can be seeded in a substrate that is locally available, and harvested in two weeks. The following weeks more can be collected. But more work is a good thing for Argentina that, like most nations with economies in transition, faces the challenge of too many people leaving rural areas hoping to find work in cities. The new and

labor-intensive work of mushroom cultivation supports re-ruralization and comes at a good price: processed mushrooms sell for 1,000 dollars per ton compared to a soy price of 300 dollars per ton. Argentina is the largest producer of pears in the Southern Hemisphere and the fifth largest apple exporter of the world. All these trees in the Provinces of Rio Negro and Nuenquen, each tree needs to be pruned leaving an extraordinary hardwood behind that is ideal for mushroom farming. This market segment should not be a commodity, mushrooms should be a produced with added value ensuring that more new jobs are generated than can ever be imagined today.

Intensive farming crops like soy uses large and expensive machinery and equipment. That requires big investments that drive concentration of power. As a result, the returns don't easily distribute wealth and employment throughout the economy. Mushroom cultivation creates jobs. For example: In the past decade, the introduction of shiitake mushroom cultivation has created 20,000 jobs in the United States. That economic success surfs on a trend of changing appetites. Names like shiitake, enoki, oyster and portobello were not very familiar until recently but today can be found in all supermarkets.

In the past, it was not so easy to enter the mushroom farming market. Cultivation was energy-intensive because the standard methodology to farming prescribed sterilization. The costs of sterilization—steaming the substrate during hours—made up some 50 percent of the production costs. It also required access to an energy infrastructure that made starting a mushroom farm complex.

New techniques demonstrated around the world make it possible to grow mushrooms very efficiently without the need for sterilization. That allows for small-scale cultivation. As in the story of Zimbabwe, it starts with one initiative. Then the next one. But it is so easy and it requires so little investment that it can spread like wildfire. Anyone can grow a first mushroom harvest of 100 kilos in two weeks with an investment of 500 dollars. Within two months the initial investment is earned back while

they scale their production step by step to perhaps as much as 1,000 kilos per day. Larger operations that start with a production of 1,000 kilos per day require a bigger investment of about 50,000 dollars.

Raw material is available everywhere: the saw dust of the saw mill in Tierra del Fuego, the waste from the soy processing mill in Santa Fe, or the clippings from fruit trees in Río Negro, Neuquén, Mendoza, La Pampa y San Juan. There's a massive opportunity to scale mushroom farming through the farmers' networks of Argentina. Argentina can become a leading mushroom producer next to China as the most successful mushroom farming nation in the world. The leading centers of mushroom farming in China employ 100,000 people in areas that equal San Francisco. Total employment in China exceeds 3 million mushroom farmers. The precondition is that the raw materials are in abundance. There is no doubt that Argentina has multiple centers with an abundance of biomass ready for conversion into a substrate.

Argentina can launch this new mission with a first generation of 100 mushroom cultivating enterprises. Not just in the rural areas, but in cities as well. Coffee grounds provide an ideal substrate for growing mushrooms. And there's no shortage of coffee shops in Argentina… it is part of the culture. Chido Govera came to Buenos Aires to share her experience and Julien Laurençon from the Comunidad Huerta has 5,000 farmers who are dedicated to the production of fruits and vegetables ready to embark on the farming of mushrooms. They have an established network of clients based on the proven business model of community supported agriculture and will provide the training for first 100 mushroom farmers. Mushroom farming means using waste with hardly any value to create a lot of value.

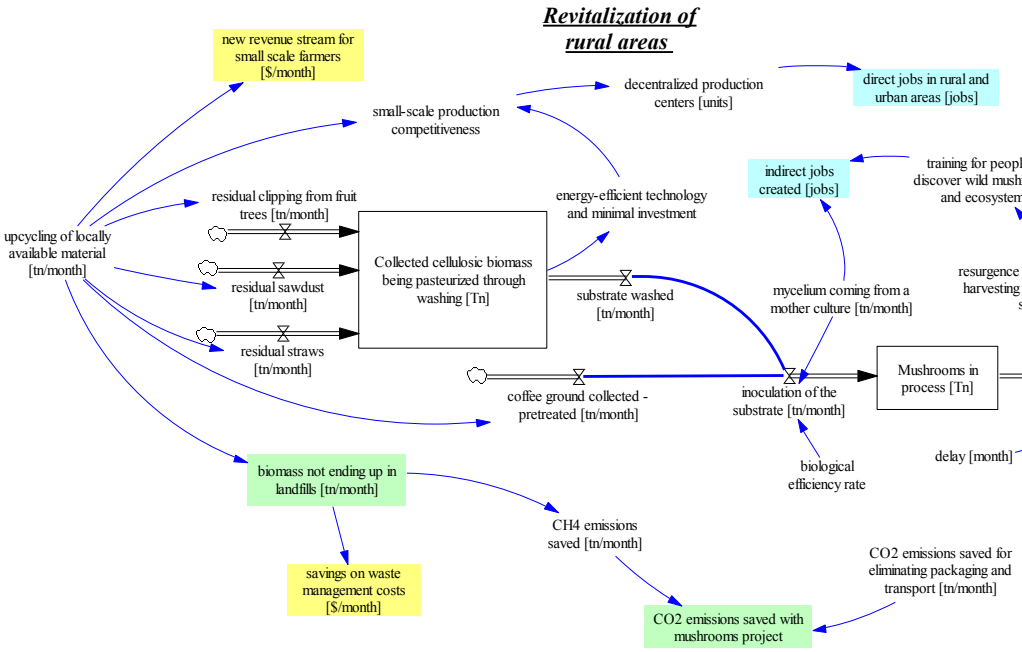
Mushrooms are 50 times more valuable than compost. In fact, the compost that mushrooms leave behind after harvesting is of a higher quality because it has been enriched with nutrients for micro-organisms. Mushroom cultivation fights malnutrition and global warming while it has the potential to create hundreds of thousands of jobs in a low-capital cost, decentralized way. Finally, mushroom farming fills a gap in natural cycles. Farms grow food. The organic waste of the farms is used to grow

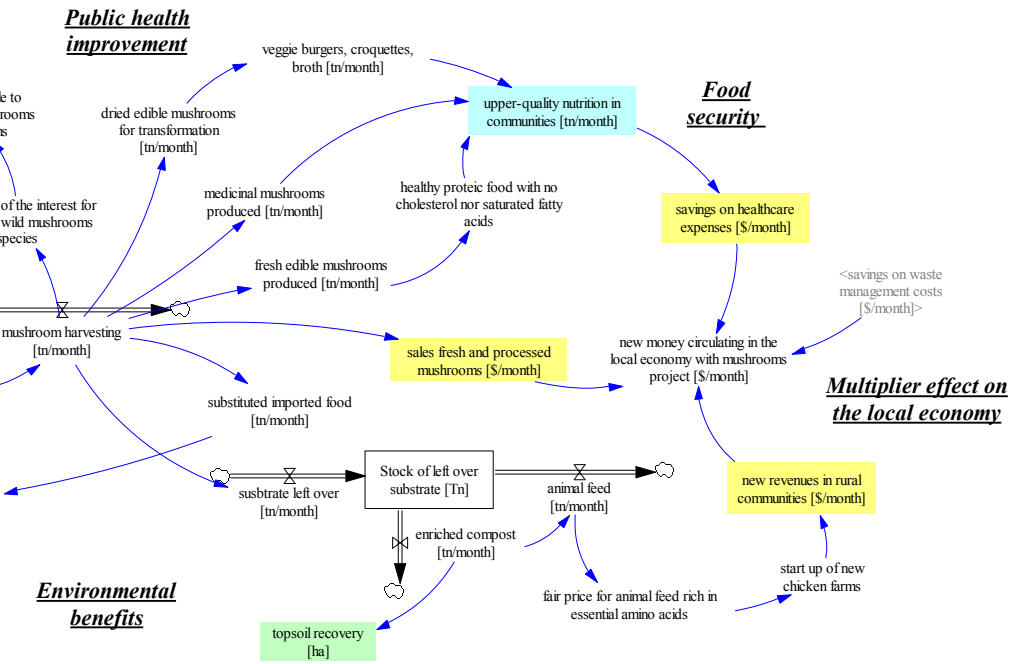
mushrooms. What's left after the mushroom harvest is perfect feed for animals. And the manure of the animals is a high-quality fertilizer.

It's a natural cycle where value—income, nutrition, employment—is added at each step. Adding value means building local communities and economies. That's what governments want to do.

Plan A

Clustering mushrooms with coffee




Public health improvement
veggie burgers, croquettes, broth [tn/month]
upper-quality nutrition in communities [tn/month]
Food security
dried edible mushrooms for transformation [tn/month]
medicinal mushrooms produced [tn/month]
healthy proteic food with no cholesterol nor saturated fatty acids
savings on healthcare expenses [$/month]
fresh edible mushrooms produced [tn/month]
<savings on waste management costs [$/month]>
mushroom harvesting [tn/month]
sales fresh and processed mushrooms [$/month]
new money circulating in the local economy with mushrooms project [$/month]
Multiplier effect on the local economy
substituted imported food [tn/month]
Stock of left over substrate [Tn]
susbtrate left over [tn/month]
animal feed [tn/month]
new revenues in rural communities [$/month]
enriched compost [tn/month]
start up of new chicken farms
fair price for animal feed rich in essential amino acids
Environmental benefits
topsoil recovery [ha]

Fable 3

Shiitake love caffeine

Organic waste should never be called waste. The waste of one is always food for another, belonging to another kingdom. This is the marvel of cascading nutrients, energy and matter, that what is left over for one is valuable input for another and this is how each species of nature has found its own niche capable of increasing the productive cycles. The food cycles have concentrated on plants and animals but mushrooms offer a unique contribution that makes the overall output more productive than genetics and chemistry can ever achieve, while offering a broader and healthier portfolio of food.

A group of earthworms is working its way through a pile of organic waste.

"I need a rest!" screams the old earthworm, "but I still feel so energized, so hyper!"

"I feel the same," say its' 1,000 babies (who were all born last month) in chorus.

"How can we ever tell these people not to throw coffee or tea on the compost heap?" whispers the father earthworm.

"Right, they do not like to drink coffee before they go to bed, so why do they throw all this caffeine in our face? I am stressed out!" says the youngest of the colony.

"Well, well, what do I hear?" wonders the shiitake mushroom. "Are you all suffering from too much caffeine?"

"You see, these people have learned they cannot feed it to cattle, even when it is rich in nutrients, like protein, otherwise the cows get stressed, and give less milk."

"And since you do not give milk, people do not know that it bothers you?"

"`Well, they do not know what we are going through, but having to eat and digest your own weight every day is quite a job."

"I can help," says the shiitake, "I can grow here and get my energy from the caffeine."

"What? You do not get stressed from caffeine?"

"No, actually the more caffeine there is, the better for me. I use it to grow and convert the caffeine into food for others. You will be able to eat all the organic waste and not get stressed. Even cattle would be able to eat it!"

"Wow, that would be great. But how does this work?""You are an animal, coffee is a plant, and I am a fungus, and we belong to three different kingdoms."

"I know that even though we do not have legs, and we are blind, we belong to the Animal Kingdom," says the earthworm.

"So, animals suffer from caffeine, but some fungi can live with any fiber even if it includes caffeine. Then we produce waste, rich in protein, with no more caffeine."

"That is great! You fungi make the food that we can eat, we earthworms prepare food for plants, and the cattle eats the plants! Everyone works together and this way no one gets stressed."

... *And it only has just begun*!

The Opportunity
"Integrated Biosystems"

output factor 5
jobs factor 3

Argentina has the resources to increase output beyond mushrooms and fly larvae cascading nutrients, matter and energy efficiently increasing quality of food. The key driver is the increased value of land, measured in cash flow generated per hectare.

Germany (Bavaria) and Spain (El Hierro) have demonstrated that this model is highly profitable and complementary to the existing monoculture approach.

Plan A

Chapter 3

The power of fish, pigs, goats, milk and cheese

Argentina leads the world in two statistics. The country cultivates the highest percentage of genetically modified organisms, GMO crops and it is also the largest consumer per capita of pesticides and herbicides. These are interesting facts. Since, wasn't the introduction of GMOs meant to decrease, if not eradicate, the use of pesticides and herbicides?

Beneath this apparent contradiction lies the core principle of modern industrial agriculture: standardization. The prevailing logic is that whatever we can standardize we can measure, and then we can control—the same ingredients fed into the same process will produce the same outcome. Since the Industrial Revolution, the system has worked well for factories that produce the same products all the time. In the past century, we have applied this logic with success to the assembly of cars, computers, and televisions—this is where robots come in handy. However, we have applied exactly the same industrial model to the way we grow and produce food—that is, we have applied our industrial model to nature. The supply chain of steel to wheel has been pushed to apply the same logic to soil and seeds, and from farm to fork. As a result, the whole world population today basically eats five plants: wheat, rice, corn, soy, and palm; drinks one

type of milk (from the cow, of course); and eats meat from three animals: pigs, chickens, and cows.

Around the world, five crops and the meat and dairy industries are controlled by a few corporations that have perfected the complete chain, from the genetics to the processing and the delivery to the consumer. Everything is cultivated in nearly exactly the same way—from the planting of the seeds and the handling of the artificial nutrients of the soil to the processing of the harvest. Farmers are increasingly transformed into laborers that supply a piece of land and follow precise instructions to ensure the predictability that is demanded by the food multinationals. The reason is simple: The corn flakes you buy in Paris need to taste the same as the corn flakes you buy in Buenos Aires, and the nutritional labels are exactly the same. It is all about predictability and eradicating risk in a very fragile system. The same applies to the color of the salmon or the pork belly, and to most other produce and animal protein you buy in the supermarket, wherever you are. If we would leave it to nature, food from different places would always look and taste differently.

Universally identical red ketchup, golden corn flakes, and pink salmon are the results of our attempts to force biology to become predictable, thus reducing the business risk and increasing returns on the investments of the food multinationals. We have strived to master nature with monocultures and with GMO. It is a mission destined to be a temporary success only because nature always adapts and responds. Bacteria swiftly create new varieties that undo the human genius. That's why Argentina consumes so many agricultural chemicals despite heavy investments in GMO.

Industrial farming has another important negative side effect: it has significantly decreased the population density in the countryside. Somehow economists have equated the decrease in employment in the primary sector with progress. This is certainly not a sign of development and modernization if the price society pays is the loss of nutritious food, the dramatic increase of diabetes and obesity as well as the disintegration of rural communities. At the same time, the ongoing trend of urbanization is challenging the ability of the government to meet and satisfy the basic

needs of the population. Poverty is increasing and personal security is decreasing. Ultimately, industrial farming threatens the economic and social stability of Argentina. It is, therefore, critical that the country seeks the development of local, integrated and sustainable economic alternatives.

Industrialized farming goes against the logic of five billion years of evolution, where fauna and flora embarked on a never-ending quest to evolve and diversify. Monocultures create disease because they "invite" pests, and an explosive growth of wild plants—let us not call these weeds—that are keen to fill the ecological niche that is left open and unused. Monoculture farming, driven by the desire to master nature, contains this inherent flaw: It ignores the way nature works. Nature uses its "five kingdoms"—bacteria, algae, fungi, plants, and animals—to preserve diversity, balance, and hygiene, promoting life and building up social capital with resilience. Nature continuously shifts action, matter, energy, and nutrition from one kingdom to another. A virus that attacks a pig has no effect on a plant. A virus that eradicates shrimp farms or undermines banana plantations is irrelevant in a spirulina production pond. And none of these viruses can survive when they get in the bacterial environment of, for instance, a biogas digester in the presence of very little oxygen and abundant production of methane.

Nonetheless, if the virus does survive the digester, it cannot survive in the high pH environment of an algae pond. The biodiversity that is the power of nature is not made only from different species, but also from different families that create different living conditions inside particular niches within the ecosystem. With "environmental shifts" of dynamic life conditions—including acid and alkaline, aerobic and non-aerobic, high and low temperatures, with or without magnetism, inside or outside a cell, high or low water surface tension—nature provides conditions that are enhancing all aspects of life. Nature has no need for weed, fungal, or pest control since the system responds and adapts continuously in diverse ways, and improper imbalances are quickly corrected without the need for toxic external support.

The agriculture of the future is not GMO-based; it will be modeled on nature, and Argentina can follow China as a pioneer and leader of this approach. Integrated farming based on the laws of nature is superior in productivity; it generates more value and jobs and permits nature to regenerate its soil. Sustainable rural communities—with full access to all the resources of the information society—that locally produce food and energy can offer opportunities for employment and entrepreneurship and revitalize rural areas.

Argentina, with its large expanse of fertile and flat land and with an abundance of water, is ideally positioned to transform industrial agriculture into integrated biosystems that turn waste into food and fuel for the whole country. Food and fuel production increases and new possibilities for value creation arise. In integrated biosystems, organic molecules can cycle indefinitely while continuously regenerating nature.

Given the challenges of Argentina's urban centers, it may be tempting to try to implement new agricultural solutions in these places where the need is highest. However, it is a typical flaw of industrial thinking to look for solutions where we want them to be rather than in the best place where they are available. Integrated farming does not flourish in large-scale environments but in a distributed system with different forms and scales of production. Argentina has a rich potential to produce food and fuel from biomass that is spread out across the vast country. The following example illustrates how a focus on local resources generates an abundance of value.

Cluster 1: beer, pigs, fish, energy and rice

Twenty years ago, in Fiji ZERI first applied this approach in an effort to dramatically increase output. In cooperation with Professor George Chan, we set out to demonstrate the performance of food production based on traditional Chinese systems. Chan, who was trained at Imperial

College of London, had a career as the water engineer in his birth town of Port Louis, Mauritius, and as an environmental engineer for the United States Environmental Protection Agency (EPA) in the Pacific. After his early retirement, he decided to study traditional farming in his ancestral homeland, China.

The islands of Fiji enjoy abundance, but the soil is considered poor and hardly anything grows in the slippery clay. Chan decided to focus on the Montfort Boys Town, a technical school located outside the capital city of Suva. There, students learned how to farm fish in an attempt to make the school self-sufficient in food. The school was following the "scientific" technique based on the fattening fingerlings of an imported species (tilapia) with imported feed in shallow ponds. The success was measured in tons of output, not in concentration of nutrition. It is a very inefficient—and expensive—system that works only with free labor: the students!

Chan set out to demonstrate that it is possible to farm fish without having to buy feed for the fish, because—as he argued—nowhere in nature are fish artificially fed. The first step was to deepen the one- or two-foot-deep shallow ponds to ten feet. Chan used a traditional efficient technique, deepening the ponds some four feet, and then used the excavated earth to build four-foot-high dykes around the ponds. The next step was to gather seven types of fish. Chan was keen on having fish that live at each trophic level; some like to eat the grass on the top, some like to dredge the bottom for food, and in between, there was a variety of food for different fish—like zoo and phytoplankton, benthos, and the undigested food from other fish. It was quite surprising how precise each niche was occupied by different species, and how a 3D model of fish farming unfolded where the 30,000-square-foot pond turned into a 350,000-cubic-foot pond with a diverse and secure food supply. The output had increased by a factor 15, with seven species, instead of only one, in a pond that had expanded from two to ten feet deep. Traditional agricultural economists would consider this improved output impossible to achieve—and it is in a two-

dimensional environment. However, the result can be easily explained and understood when one realizes that the productive system incorporates a third dimension.

Still, the fish had to be fed at substantial cost. Chan began planning to eliminate these expenses with a mushroom farm that used grains from the local beer producer, located a few miles from the school. He also started a piggery. The pigs where locally bought as one-month-old weaners and were fed the spent substrate after harvesting the mushrooms. The pigs were trained within a few days to go to the corner and keep the pen clean, a relief for anyone working on the farm since the least pleasant job is most likely the brushing of pig excrement into a drop hole that feeds the fermenter. This digester produced biogas that was used to sterilize the mushroom substrate. The slurry from the digester was further mineralized in algae ponds, and the beta carotene-rich algae that naturally grew were used as a feed additive for the pigs. The algae oxidized the water even further and increased the pH, which allowed for cultivating and daily harvesting of spirulina. The alkaline water full of minerals in the algae pond turned out to be the ideal feed for benthos, zooplankton, and phytoplankton, which provide ideal feed for fish. And the fish were also fed daily cut grass that was growing in the quality topsoil used to create the dykes around the pond. The water became so rich in nutrients that a few floating platforms were added to farm rice, and the excess water was used to irrigate the clay-like land around the pond that once was unfit for farming but now was able to provide at least two harvests a year.

In a year, Chan had created an integrated ecosystem where each step was generating revenue while the fish were farmed without buying feed. The only investment had been the creation of two piggeries hosting in total 240 pigs per year. The revenue per hectare increased to US$15,000, an income level unheard of in the world of farming. The Fiji experiment showed how animal protein—pigs and seven types of fish—could be produced while harvesting starch-and carbohydrate-rich plants, algae abundant in beta carotene, and a total of 12 sources of food from the same land. This integrated biosystems approach has the highest efficiencies in output,

provides the best revenues for farmers, and is independent from chemical inputs because of the protection provided by the five kingdoms. The Fiji case demonstrates the way to food security, surpasses any GMO project in terms of efficiencies, and yields by a multiple and can be replicated in many different places, including urban environments. It also embraces the diversity of all kingdoms and as much diversity as possible within each species as well.

Several regions of Argentina have an abundance of water. In these regions fish farms have been created that today have achieved the level of productivity and revenue that is comparable to where Montfort Boys Town stood at the outset of the transformation program. That means, for instance, that there is a great investment opportunity in regions like the province of Entre Rios. A field visit to the locality of Avigdor demonstrated that the soil fertility and biodiversity of this region allows for extraordinary opportunities for organic food production in integrated systems that can attract young entrepreneurs. The investment costs are limited to excavation and labor and are estimated at 6,000 to 10,000 dollars per hectare. After that initial investment, ongoing revenue is guaranteed at low operational expenses offering returns in excess of 50 percent.

Cluster 2: Chickens, pigs, sausages, quality nutrition and land value

Argentina already produces high-quality grass-fed meat without adding antibiotics. There is a great opportunity to add even more value to the meat industry based on a model developed in Germany. German sausage producer Karl Ludwig Schweisfurth discovered the limitations of the standardization of industrial farming in his own way. Schweisfurth was the owner of Herta, one of the world's largest sausage companies. His father started the business in 1902, and after his training at American meat-packing plants, he introduced the same logic of economies of scale

and cost-cutting drives to become the largest meat-processing company in Europe. Every week the company would transform 25,000 pigs and 5,000 cows—1.5 million animals each year—into sausages and cuts of meat. Herta was profitable, and it was poised for growth worldwide because of the excellent technical performance and strong German brand that stood tall in terms of quality. But Schweisfurth's children didn't like the business. In fact, his two sons and one daughter rejected the very business model on which the wealth of the family was built. One son had become interested in agro-ecology and the other had become a pioneer of health food stores in Germany.

Then, Karl Ludwig Schweisfurth did something that very few successful entrepreneurs are capable of: listening to his children, he radically changed his course. He sold his business to Nestlé and joined his children in a new endeavor to transform the industry from the bottom up. The Herrmannsdorf farm in Glonn, outside of Munich, was born. Karl Ludwig and his sons Karl and Georg—against a wave of ridicule and critique—created a 250-acre farm where everything is vertically integrated—just like farming used to be. They redesigned the business model for food, with quality measured by the value of nutrition as the top priority in everything that is produced. Food-industry experts balked at the price Herrmannsdorf set out to charge for its food, which is easily double the price of comparable products in supermarkets. However, the arguments were clear from the start: The food is not comparable pound for pound; the difference is in the nutritional value. On the basis of nutrition, Herrmannsdorf meat is cheaper; on the basis of weight, it is outrageously expensive. So, what should the economist opt for: Have cheap food and high cost of health care or save vast amounts of money by selling healthy food that on the basis of its nutritional content is far superior?

Herrmannsdorf demonstrates that the market responds to a business model where feed is produced locally; chickens and pigs, females and males, roam the land together with ducks and goats; where chickens feast on the insects bothering the pigs; and the pigs provide heat to the chickens in the winter. The animals are cared for double or even triple the time

that industrial piggeries or chicken batteries consider competitive. All animals can walk to the boutique sized slaughterhouse where they spend the night with friends before being sacrificed with great care. Their meat is processed immediately at their body temperature and nothing gets lost. Herrmannsdorf shows that food is—as the Germans say—Lebensmittel, a means to live. The processing is carefully undertaken: from the preparation of the soil to the selection of the feed for the animals, who are chosen from traditional varieties for taste and resilience to weather patterns, and, finally, to the skills of the butcher and the makers of delicatessen that stand out in quality and taste.

The success of the integrated model is based not only on mastering the production and processing of food, but also on the distribution. The Schweisfurth family refuses to work with supermarkets and has established their own distribution channel based on the experience and contacts of son Georg in the health food and organic stores sector. The fully integrated and controlled chain from feed to farm to shop is even extended to their own restaurant and hotel, and to a catering service. Nobody expected the business to succeed, but today the whole business provides so much revenue that it is almost embarrassing, and demand for more comes not just from Germany but from everywhere in the world. Herrmannsdorf has integrated farmers in the region who now follow the same logic and ethics, and the farm has supported the start-up of numerous other farms.

Some comment that the Hermannsdorf model is too capital intensive and only for the rich. The counter argument is that Herrmannsdorf delivers much better nutrition, much better value, and, therefore, deserves a higher price. Moreover, Herrmannsdorf meat offers such a multiple value that one can eat less and still get more nutrition. Pigs that are reared at the Herrmannsdorf farm have a higher incidence in beta-carotene, the highly sought-after nutrition that has made salmon so popular. The presence of this quality nutrient alone offers a compensation for the fact that the animals are kept a minimum of one year instead of the typical 6 months. Ultimately, better nutrition contributes to better health, and will thus lead to savings on health care expenses. Still, there is a challenge for consumers

society-wide to make the shift. Arguably, the people who need the more nutritious food the most are the ones who can't afford to pay the higher price of Herrmannsdorf sausages.

Argentina has an extraordinary opportunity to add even more value to this core industry through adopting the Hermannsdorf-model. The investment would improve export revenue as well as public health in the country. Apart from the cost of the acquisition of the land (100 hectares), the investment in infrastructure to create a "Hermannsdorf farm" is estimated at 3 million dollars, including the slaughterhouse, the processing center, and the nursing site for chickens and pigs. The income generated on that farm reaches 30 million dollars per year with a 10 to 15 percent net return while generating more than 280 full time well-paid jobs. However, the real value is—beyond the sales—in the increase in asset value. A traditional hectare that produces maximum 20 tons of protein under ideal circumstances valued at 350 dollars per ton in ideal conditions only offers a cash entry of 6,000 dollars per year. The integrated farming model generates a multiple of five reaching 30,000 dollars which immediately translates into an increased valuation of the land itself.

Re-evaluating Argentina's opportunities from the perspective of integrative farming inspired by laws of nature, with a permanent search for more produce and more cash flow may also lead to different choices. The pre-dominant beef industry may not serve the needs of the country best everywhere. In certain regions, feeding cows with soy may not be the best farming system at all.

Cluster 3: goats, milk, yogurt, organic fruits and cheese

Twenty years ago, El Hierro, part of the Canary Islands off the coast of Spain was an island in search of a future. The livestock situation was analyzed, and farmers recognized that feeding cows on the island was inefficient. Cows are not native and need additional, imported, feed especially in the winter season, and the dry land is incapable of producing

local hay in volumes that warrant the local supply. This increases costs. Goats, however, stood out as the ideal animals. Canary Island goats are champions in meat and milk production. A renewed focus on goat farming, specifically on the creation of higher-value products, subsequently led to a remarkable economic recovery. Today El Hierro ranchers get about €2.65 per liter for their goat milk, which is converted into cheese and yogurt. That is ten (!) times more that the subsidized tariff paid for milk by the European Union. The star product is fresh yogurt, served with organic banana and pineapple, that is sold locally and on the adjoining islands. The goat business on El Hierro is lucrative and attracts young people from Spain, which is suffering from a very high youth unemployment rate. With only 50 goats that produce two liters a day, a farmer can make about €100,000 per year. The investment for a flock of 50 with a minimum milking and rearing infrastructure requires no more than €15,000 per farm. A processing center for the production of milk, yogurt, cheese, meat products requires a joint investment of 1.5 million Euros. The expenses are limited as the feed for the goats is free and the living costs on the island are much lower than in any Spanish city. How many young people can imagine such revenue, which tends to increase provided that there are no more than 50 goats in the herd. The reason? Research has demonstrated that goats appreciate care and attention, and when given the proper attention, they reward the rancher with more milk. That limits the natural scale of a healthy, productive ranch.

The El Hierro model was subsequently copied on the Dutch Caribbean island of Bonaire. Here goat milk was turned into ice cream and sold to the many tourists visiting the island with cruise ships. The logic was quick and clear: the cruise ships that disembark on the island leave their passengers a couple hours to stroll the avenue of Kralendijk, the Capital city of Bonaire and eat an ice-cream. Tourists are willing to pay 6 American dollars for a Häagens-Dazs, that offers the consumer 50 percent of its daily intake of saturated fat and 30 percent of its cholesterol and only 10 to 15 percent of the product is actually milk and 25 percent is sugar. The local goat herders could sell the same ice-cream with sugar cane from the island at least

5 times cheaper and add flavors from the island no Haagens-Dazs fan would ever have encountered.

The examples of El Hierro and Bonaire provide inspiration for the transformation of the struggling dairy industry of the city of Rafaela, the capital of the province of Santa Fe. The milk industry is suffering from a downward price spiral driven by intense standardization and concentration. The expert team from ZERI Brasil evaluated the challenges with the company Williner, a leading player in the regional dairy industry, and discovered an interest and willingness to innovate and explore integrated biosystems including fermenters, microalgae production, and power generation. The Brazilian energy company GeoEnergética (Plaenge Group) owned by Fernando and Alexandre Fabian has demonstrated already how successful this avenue can be. Anderson Sakuma, the Plaenge scientific expert on bio-energy who was trained by Prof. George Chan, joined the project team in Argentina on special assignment and concluded that Argentina has a tremendous future and worked out specific investment opportunities.

The situation in Rafaela illustrates the challenges and opportunities for Argentina. As a first step, the country needs to begin mapping all processes used—from planting food to livestock breeding. That process needs to establish where raw materials are being used and where waste is being generated and how new value can be generated by (re)directing production cycles from the small dairy producer to the final milk processing plants. Argentina needs to know in detail the organic matter existing in the entire production system associated with the production of milk and milk products. And how that organic matter can be used in an integrated way to produce energy as the production of energy is a key strategic issue in Argentina.

Argentina has an abundance of natural resources and hosts 55 million cows, 14 million sheep, 4 million pigs, 3.5 million goats and 115 million chickens. Only 20 percent of the animals in the country are fattened in feedlots; 80 percent is still produced extensively due to a great integration with the production of feed. The healthy, high-quality meat production is

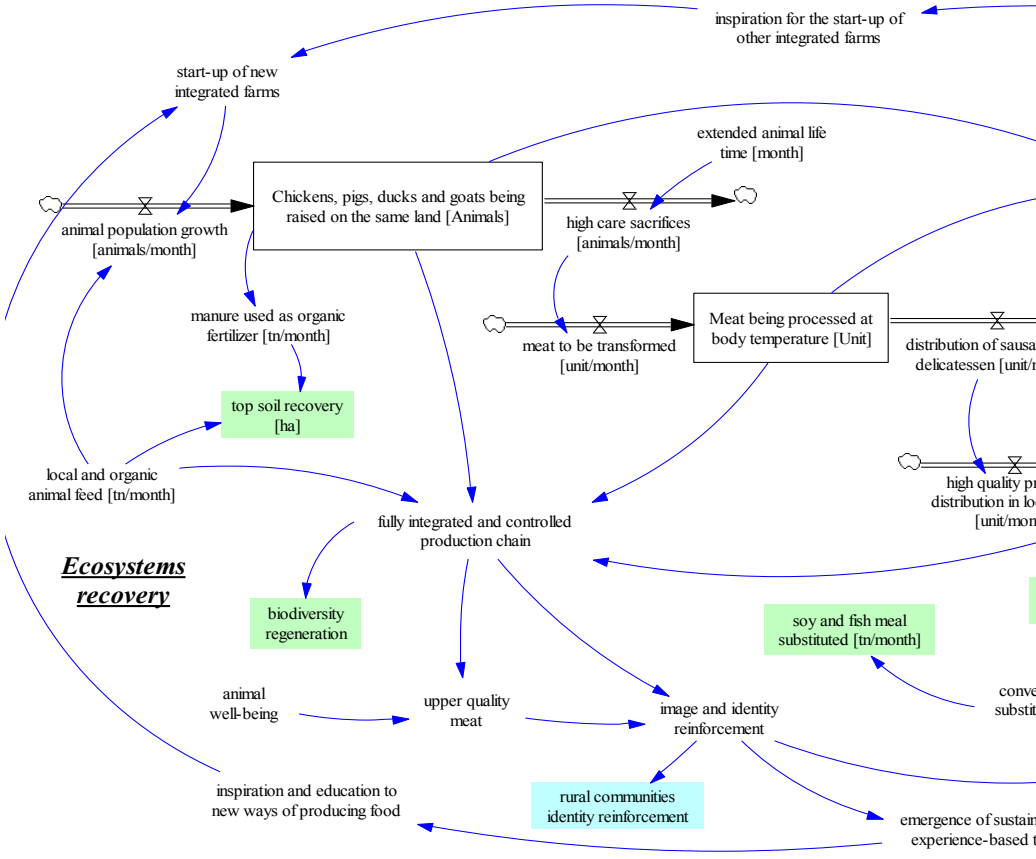
free from mad cow disease and is good for an annual export value of 1.5 billion dollars.

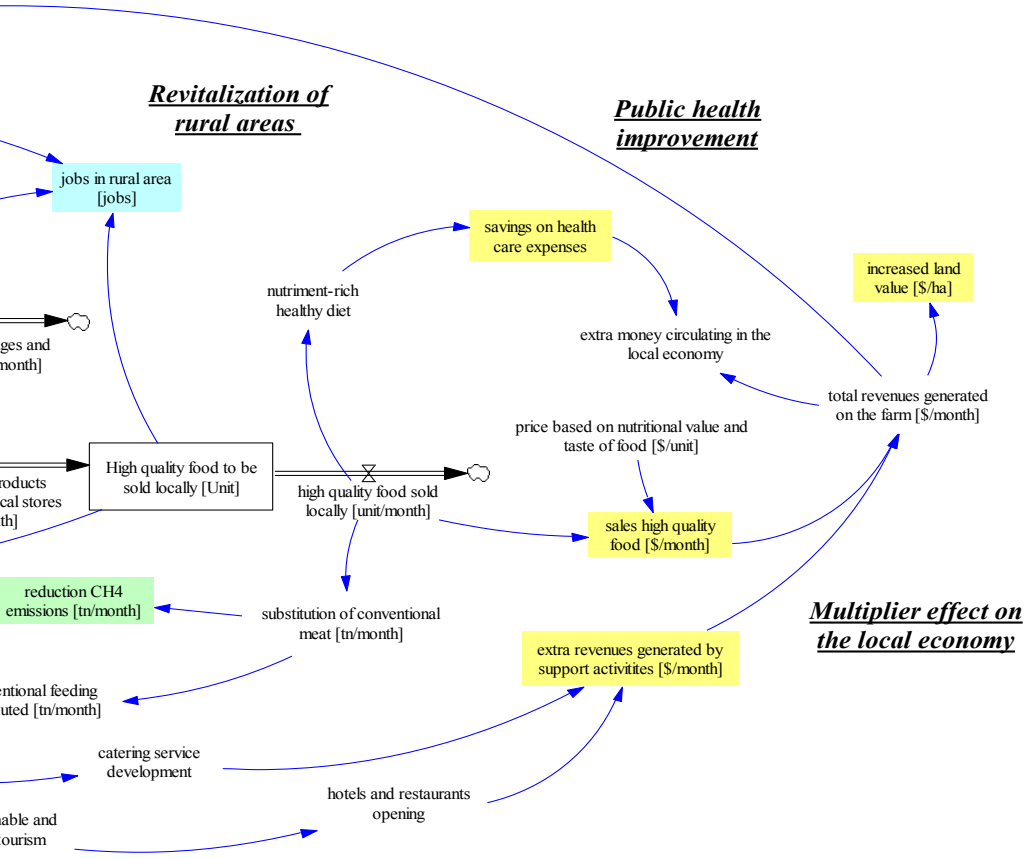
Nonetheless, integrated farming can vastly improve the output for the country. For instance: the production of milk and meat has traditionally been separated. But if these farming systems were integrated, productivity would substantially increase and much more value—income, jobs—could be created. That is a critical shift as the production of milk dropped 11 percent in 2016 because the prices fell so low that Argentinian farmers found it impossible to continue to compete.

The cases described in this chapter offer tremendous opportunities for investors to increase the value of Argentinean agriculture. Farming output can increase 5-fold while employment triples and margins increase. With an integrated farming approach existing resources can create an abundance of value to benefit communities across the country. At the same time, this systemic shift will replenish top soil, and regenerate nature ensuring that generations to come will continue to enjoy the richness and wealth of Argentina.

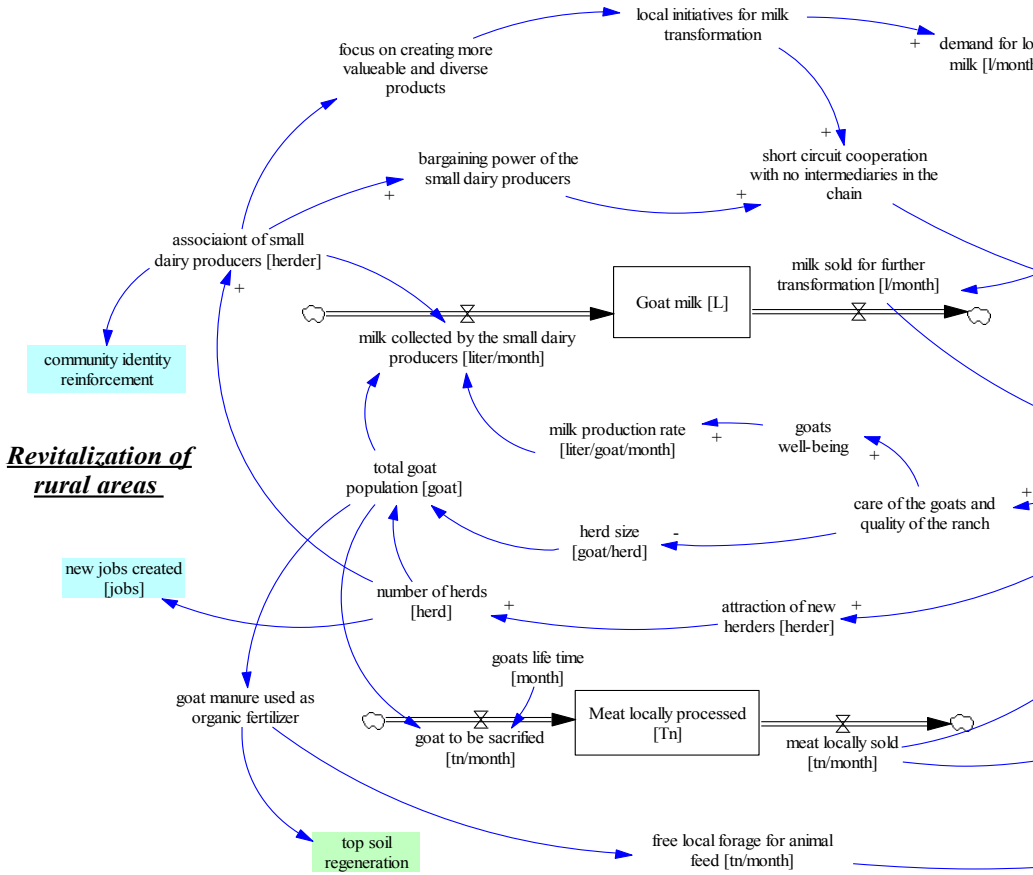
Plan A

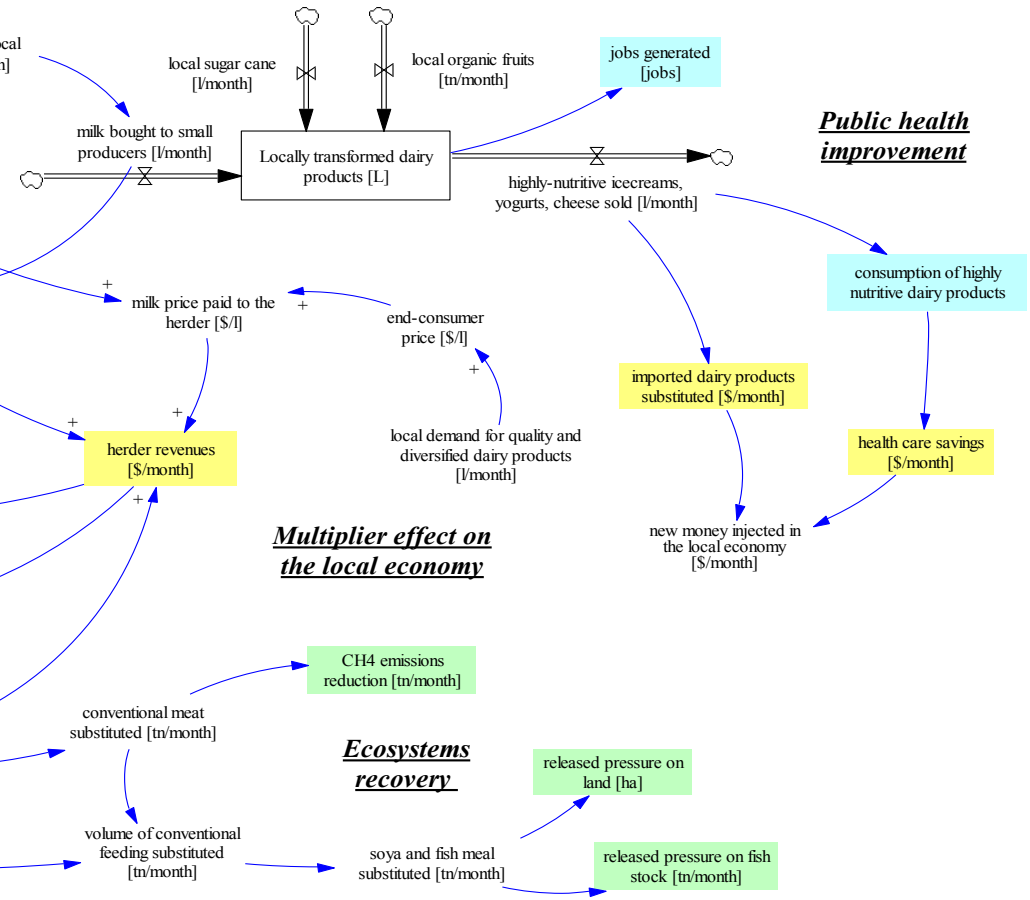
A. Integrated biosystems: chickens, pigs, quality nutrition and land value




Revitalization of rural areas
Public health improvement
jobs in rural area [jobs]
savings on health care expenses
increased land value [$/ha]
nutriment-rich healthy diet
extra money circulating in the local economy
total revenues generated on the farm [$/month]
price based on nutritional value and taste of food [$/unit]
High quality food to be sold locally [Unit]
high quality food sold locally [unit/month]
sales high quality food [$/month]
reduction CH4 emissions [tn/month]
substitution of conventional meat [tn/month]
Multiplier effect on the local economy
extra revenues generated by support activitites [$/month]
catering service development
hotels and restaurants opening

B. Integrated bio systems: goats, yoghurt, organic fruits and high milk prices




local sugar cane [l/month]
local organic fruits [tn/month]
jobs generated [jobs]
milk bought to small producers [l/month]
Locally transformed dairy products [L]
Public health improvement
highly-nutritive icecreams, yogurts, cheese sold [l/month]
consumption of highly nutritive dairy products
milk price paid to the herder [$/l]
end-consumer price [$/l]
imported dairy products substituted [$/month]
herder revenues [$/month]
local demand for quality and diversified dairy products [l/month]
health care savings [$/month]
Multiplier effect on the local economy
new money injected in the local economy [$/month]
CH4 emissions reduction [tn/month]
conventional meat substituted [tn/month]
Ecosystems recovery
released pressure on land [ha]
volume of conventional feeding substituted [tn/month]
soya and fish meal substituted [tn/month]
released pressure on fish stock [tn/month]

Fable 4

Crabs for dinner

The production of food is reaching new levels of efficiency. The monoculture aided by genetics and chemistry is increasingly outpaced by the integrated biosystems where the cascading reaches not only high levels of productivity, but also brings surprises no one would expect. What scientists have called autopoiesis, the natural path of evolution and symbiosis brings additional benefits and income that could hardly be planned for. However, productivity systems that wish to predict this would never have a chance to welcome such surprises.

The pig and the mushroom are debating why the fish are vanishing from the pond on their farm.

"It must be the birds who come to steal our fish at night," argues the mushroom.

"No, that's not possible; we are very vigilant," defends the pig. "We would have noticed. I wonder if one family of fish isn't eating the other."

"Look," answers the mushroom, "we have seven types of fish here – one for each food level of our three meter deep pond. No fish is interested in eating the other. It is possible for us to farm fish without having to buy feed for them. Perhaps they got sick and are dying at the bottom of the pond."

"You're right about the levels. The grass eaters at the top will never bother the bottom feeders. Thanks to the algae, there is a lot of plankton and many tiny snails in the water, which means that there's enough food to feed all the fish.

"I don't understand it. We used to have five times more fish than we have now, what is going on here?"

"I really don't know. Do you think there's a problem with the water?" wonders the mushroom. "I know that too many solids flowing out of your sty, but aren't these caught in the digester's filter?"

"Yes, the solids are indeed left behind in the digester. The water for this pond comes from our pigsty. The manure flows into a digester where bacteria purify the water. And the clean water is then returned to nature. Did you know that the digester also creates biogas?"

"That's interesting!" the mushroom replies.

"But if it is not the water, what could the problem be then?" the pig asks. "We have always had plenty of food sources on this farm. We are providing so much food; even the soil around us, which was considered poor for farming, started to flourish beyond everyone's expectations."

"Those who think poor soil will always remain that way, don't think properly", the mushroom replies. Some people thought the water in our pond was polluted, as there was too much food in it. But the water from the pond turned out to enrich the soil wonderfully!

"But we still need to do something about our fish disappearing" says the pig.

"So let's think. Where is the excess water from the pond flowing to?" the mushroom asks.

"To the sea."

"And what lives in the coastal zone of the sea where our water flows to?" the mushroom wants to know.

"Mangroves."

"Yes, the mangrove swamps are a paradise for shrimp, crabs, seaweed, and algae."

Plan A

"So which one of these creatures do you think can move up from the sea onto the land?" asks the pig.

"Seaweed and algae have no chance, and shrimp can hardly walk," replies the mushroom.

"Well, then the only ones that can walk up into the mangrove swamp, are the crabs!"

"You mean those funny walking crabs are feasting on our fish?" the mushroom asks.

"I think so. Do you know that crabs are the only animals who have their legs on the sides of their bodies instead of under their bodies?"

"Clearly that has not prevented them from invading our pond," says the mushroom.

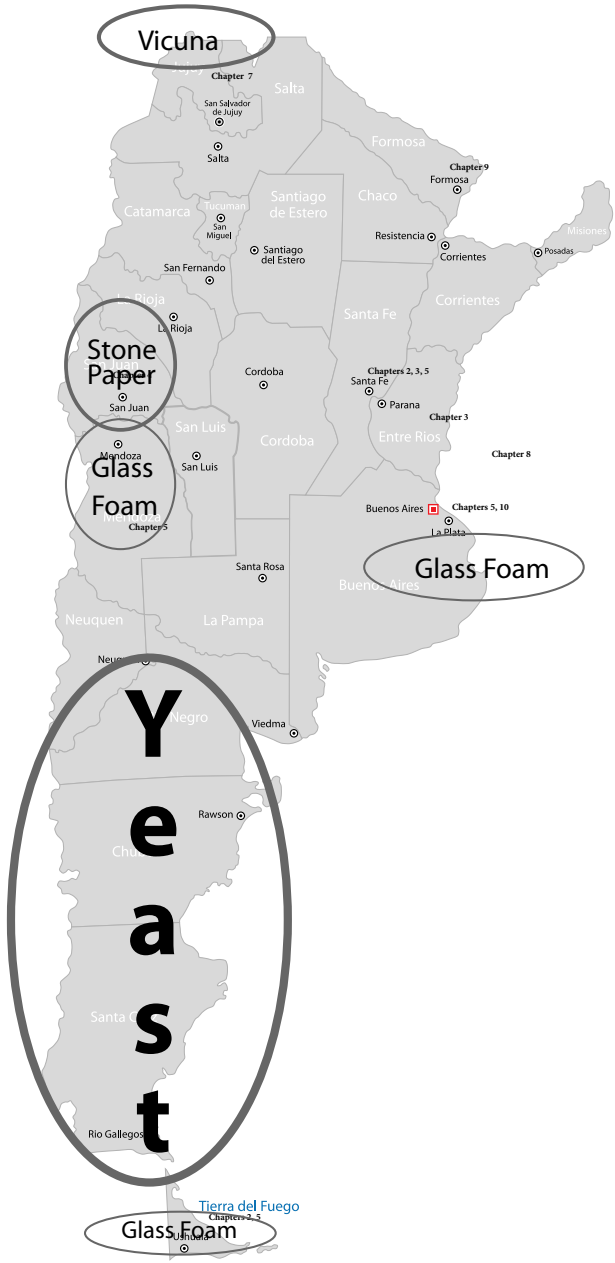
"They are probably hiding in the mud right now, ready to feast on our fish!"

"Let's dry out the pond and catch all these crabs! It will make our farmer very happy."

"He will make a lot more money by selling the crabs. And then he will have enough money to pay his kids' school fees."

... *And it only has just begun*!

Argentinian Map of Opportunities



PART B

The Value-Added Game

The Opportunity
"Stone Paper"

half cost
clean air

Argentina is a mining nation. Crushed rocks from calcium carbonate is bound with polymers (HDPE) and extruded into paper without the need for water or cellulose. It is recyclable forever without water. The value per ton of $CaCO_3$ increases from US$8 to 1,000.

China embraced the technology 5 years ago. Four factories are operational and the long term goal is to replace 25 percent of all paper saving millions of tons of water annually while releasing millions of hectares of forests for agriculture.

Plan A

Chapter 4

Saving forests, producing paper from stone

The mobile phone and the laptop you use every day may seem rather harmless, merely practical devices. Yet, that technology is the cause of major pollution and environmental degradation around the world. Modern technology depends on dozens of metals that are mined from the Earth's crust. That's a messy process that heavily pollutes the environment and scars the face of the Earth. Mining contaminates the soil and groundwater with dust and chemicals and it affects the health of the local population. Mining is also an incredibly inefficient process. For example: Gold is purified at an average of two grams per ton. That's an efficiency of 0.002 percent. That also means that goldmines produce 99.998 percent waste. On average, mines produce 10,000 tons of dust dispersed in the air every year causing respiratory diseases. That waste also suffocates local vegetation, causes erosion, poisons drinking water and threatens the health of communities.

That's why governments aim to control mining pollution with regulation and supervision. As a result, authorities play a game of hide and seek with an industry driven by economic motives. And governments are caught in a painful dilemma: mines are an opportunity—they contribute income and employment; and mines are a problem—they cause pollution and threaten public health.

Mines are even a problem for the industry. When the metals can no longer efficiently be retrieved from the earth, the mines will be abandoned and

the mining companies need to rehabilitate the environment. They need to ensure that the mined area is returned close to its original state. That's why mining companies have "closure costs" on their balance sheets. However, even after years of generating good profits, they don't like that: rehabilitation and closure costs are ongoing sources of conflicts and lawsuits.

So, governments urgently need a better mining strategy. The old model clearly does not work: pollution is hardly contained, closing mines is limited to finding trees that survive on the waste dumps and the ghost towns that remain send the communities in a downward spiral fed by poverty and violence. Governments need a strategy that goes beyond the life of the mine as only a source of ore and minerals. This is possible if there is a deliberate strategy to turn the polluting waste into an opportunity. They need a strategy that relieves them of the task to act as conflicted policeman who wants to prevent harm but is also part of the problem. Such a strategy exists and it was invented in China. The original objective was not to find a way to clean up the mess of mining. The tremendous potential of benefits for people and planet was an unexpected side effect, an unintended consequence.

Necessity is the mother of invention. China does not have many trees nor much water. But the fast-growing country needs paper. It is one of the few countries in the world with a large and continued increase of consumption of paper. Thus, the Chinese invented stone paper!

This breakthrough innovation was presented in the 1990s by the Lung Meng Technology Group after 10 years of research. Lung Meng succeeded in producing paper through mixing crushed stones—calcium carbonate ($CaCO_3$), the most abundant element in the Earth's crust—with high density polyethylene (HDPE), a standard plastic on the market that is in a desperate search for recycling. Depending on the requirements of the paper the HDPE content varies from 20 to 40 percent. It can be recycled indefinitely. And that is key mineral resources like rocks and plastics are extracted from the earth and have a useful life - forever. And where could Lung Meng easily and cheaply obtain the raw material—the rock waste—for this revolutionary new product? In mines… everywhere in the world the rock waste of mines lies piled up polluting and changing landscapes.

Stone paper presents the perfect solution to the polluting mines. Suddenly, the waste of the mines has value. Mining companies can sell their burned calcium carbonate for 8 dollars per ton. Now, their waste permits them to make additional money while cleaning up their mess. At the same time, a new stone paper factory nearby can turn that ton of waste into a ton of paper with a value of 1,000 dollars and more. The environment is saved, new income and employment is generated, communities are rebuilt and have a life for decades beyond the closure of the mine… this is the kind of new strategy the mining sector worldwide needs. And it came from an entrepreneur in China searching for a solution to a completely different problem.

The world market for paper is 400 million tons. The paper market has two main categories: paper that is used for hygiene products, and paper that is used for printing and packaging. Tissue and toilet paper need to absorb humidity. Stone paper can never replace that. However, stone paper offers a competitive alternative for printing and packaging paper and carton. That's an estimated 50 percent of the market—or 200 million tons.

Stone paper has especially game-changing potential for the packaging industry. The container with milk or fruit juice in your fridge is made from paper—carton. But that functionality requires paper to resist water and air. That's why, in past decades, composite materials—paper with aluminum or polymer layers—have been developed. Stone paper provides a better solution for packaging material as it doesn't let air or water through without the need for any additional layers.

While the overall demand for paper is decreasing around the world—with a few notable exceptions like China—, demand for specialized paper and packaging material is growing. The traditional paper market struggles to supply that demand despite major efforts to standardize the production with the help of chemistry and genetics (GMO). The industry has concentrated in megamills that produce millions of tons of paper, forcing the closing of the smaller lesser efficient production factories. Paper manufacturing is resource intensive and consumes massive amounts

of land, space and water and these megamills—like the ones constructed in Uruguay and China—require a complete overhaul of the supply chain infrastructure including ports, railways and motorways capable of handling the mega-rolls of paper. One ton of paper requires the logging of 20 trees. That means that a 5 million ton paper production plant devours an amazing 100 million trees per year. As a result, 15 percent of the agricultural land in the world is used to farm trees for making paper. It's hard to justify maintaining this reliance at a time when there is a growing demand for producing more food.

In this context, sugar cane waste and bamboo offer promising alternative fibers. Growing bamboo for paper production can be 40 times more productive in fiber content per hectare than pine trees over a 50 year period. However, the production of paper from fibers still consumes vast amounts of water. It requires up to 14 liters to produce one A-4 sheet of paper. In a world where millions of people don't have access to clean drinking water, it's hardly acceptable to spill hundreds of billions of liters of water for the production of paper. The paper industry is meeting this challenge with treatment plants to recycle water. But what about making paper from stone without any water at all?

Stone paper adds a revolutionary new dimension to the paper market. The paper is made from the waste of (coal, gold, copper etc.) mines and the processing of the ores. Instead of sacrificing precious agricultural land that can be used to grow food to feed the world and wasting scarce drinking water, stone paper solves an environmental challenge for the mining industry. This is where the nexus of the investment proposal lays. It is through the unlikely combination of the strategic interests of two totally unrelated industries that a new business opportunity emerges that changes the rules of the game in both.

Lung Meng is currently the only manufacturer in the world and operates four plants in China. Linex in Japan is the only, small, competitor and does hardly export any volume. In the first five years, the production of Lung Meng has come to 3400,000 tons per year, and the production of

Linex in Japan reached 10,000 tons. Then the Chinese engineers cracked the challenge of scaling the production system based on extrusion and succeeded in going for scale that changed cost and performance. For 2020 a total production of 1 million tons is projected. Lung Meng is focused on the domestic market but exports stone paper in limited amounts to 50 countries. The company exports 20,000 tons of stone paper to Latin America and that demand grows annually with double digits. This is where an interesting opportunity for Argentina arises.

Argentina produces 70 percent of the 2 million tons of paper the country consumes and needs to import the remaining 30 percent. That import consists mostly of specialized packaging paper, that could easily be replaced with locally produced stone paper. In other words, producing stone paper in Argentina would substitute imports and save foreign exchange while at the same time open up opportunities for regional export.

The building of a first stone paper manufacturing plant in Argentina with an annual capacity of 63,000 tons requires an investment of 100 million dollars. That comes to about 1,500 dollars per ton compared to a typical investment cost per ton in a conventional paper mill of 1,500 to 2,000 dollars. The cost per ton stone paper drops considerably if the capacity of the factory increases to the ideal level of 120,000 tons. Given the low cost of the raw material, a return on investment of 23 percent is projected based on a pre-feasibility study undertaken with the local governmental and industrial partners. Stone paper offers healthy margins as lower costs don't need to be translated in lower prices. China is showing that these projected returns are realistic. There are no paper mills in the world that can demonstrate a 10-year track record of return on investment in excess of 5 percent, unless they have succeeded in diversifying out of the core business.

The investment in the conversion of mining waste to paper will generate 300 jobs and employment can grow to 1,000 when the factory adds higher value paper products. The short-term potential for stone

paper in Argentina is promising. If the country replaces half of the paper it currently imports with domestic stone paper production, there is a 300,000 tons capacity that could be covered by three more factories.

A first ideal location for a stone paper factory in Argentina seems to be in San Juan province where 58 percent of the people are employed in the mining industry. Stone paper production will support local development as value is added to the traditional income from mining. Argentina needs economic development in rural areas to prevent a further migration to the cities leading to increasing poverty in vast non-urban parts of the country. Stone paper manufacturing will also contribute to better public health in San Juan. As the dust that the mines produced is captured for the production of stone paper, it will no longer trouble the lungs of the local population.

Argentina can become the first pioneer of stone paper in Latin America. Stone paper is a major innovation. It provides a new, ultra-smooth writing experience. It doesn't tear easily and when you drop it in water the ink remains unchanged and the paper dries as though it was never wet. Stone paper is fireproof and resists fungi and insects. Unlike natural fibers, no living species thrives a blend of rocks and plastics.

Stone paper has limitations that are gradually being met. It takes a bit longer for ink to dry on this paper since there are no fibers to absorb the ink and therefore it really has to dry on the surface. That means rotation presses can't run that fast. However, this fact also triggers market innovation to accommodate this new reality. The first generation of stone paper was up to 30 percent heavier than comparable regular paper. That increased distribution costs. That was resolved by inventing a new generation that blends air into the paper during the extrusion process. There's also a challenge with the heat involved in laser printers and copiers. But the trend is towards energy-saving equipment that don't need high heat and, therefore, today nearly all systems can easily handle stone paper.

However, there are vast opportunities for stone paper to replace paper made from wood pulp. Note that each year 4 billion trees are cut for the production of paper. Chlorine, acid, solvents and toxic chemicals,

are required for the whitening paper made from vegetable fibers. The recycling of cellulose based paper is also a filthy process creating a waste water with inks that needs special handling to dispose off. On the other hand, the ingredient for stone paper—calcium carbonate—is so white by nature that it's already used sometimes as a brightener in the manufacture of ordinary paper.

Stone paper is infinitely recyclable through a new process. Granted this works best in a business to business environment where one does not have to chase the discipline of consumers to dispose the waste paper in the right bin. The used paper is shredded into fine strips, warmed up until it has the texture of a thick dough, then it is pressed through a pasta making machines, dried and then broken down into pellets of polyethylene (20 percent) and stone powder (80 percent) without any need to use chemicals to remove ink. This is a major breakthrough since the minute amount of ink is tolerated in the process of recycling. Those pellets are extruded for a new batch of paper, with no need for additional plastic in the mix. In other words, plastic is initially required, but it can be reused endlessly to make more paper. This is the first time that synthetics are used as they should be according to their functional capacity: forever. By contrast, paper made from vegetable fibers can be recycled four to six times before the fibers become too short and weak to make a quality product.

Calcium carbonate is cheap and widely available in Argentina. A ton calcium carbonate has an average value of some 8 dollars. Turning the stone into paper increases the value to 1,000 dollars per ton. The value increases to 5,000 dollars per ton with the manufacturing of more than one hundred derivative products like food packaging cartons, (school) books, notebooks, boxes, bags etc. A unique opportunity arises to produce the cartons used for the packaging of bananas with stone paper. Latin America ships vast amounts of bananas overseas and the cardboard never returns home and is seldom recycled in the destination countries.

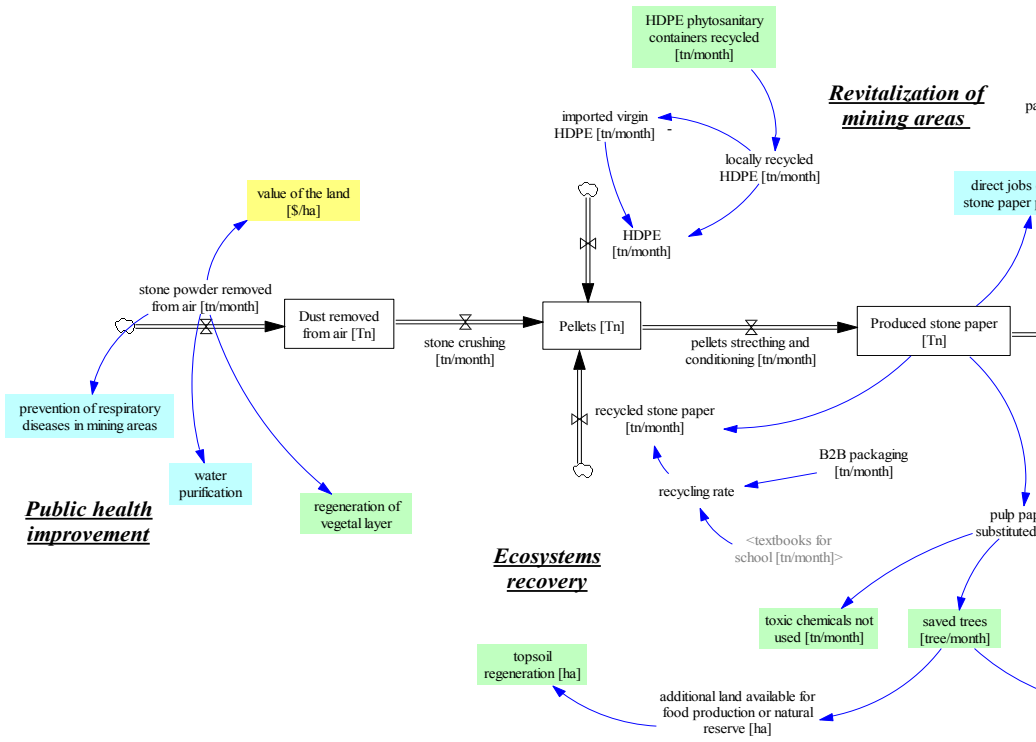
Cardboard cartons have an additional problem: they provide ideal habitats for fungi and insects. Packaging material made from fibers has limitations from a hygienic perspective. That is why these are covered

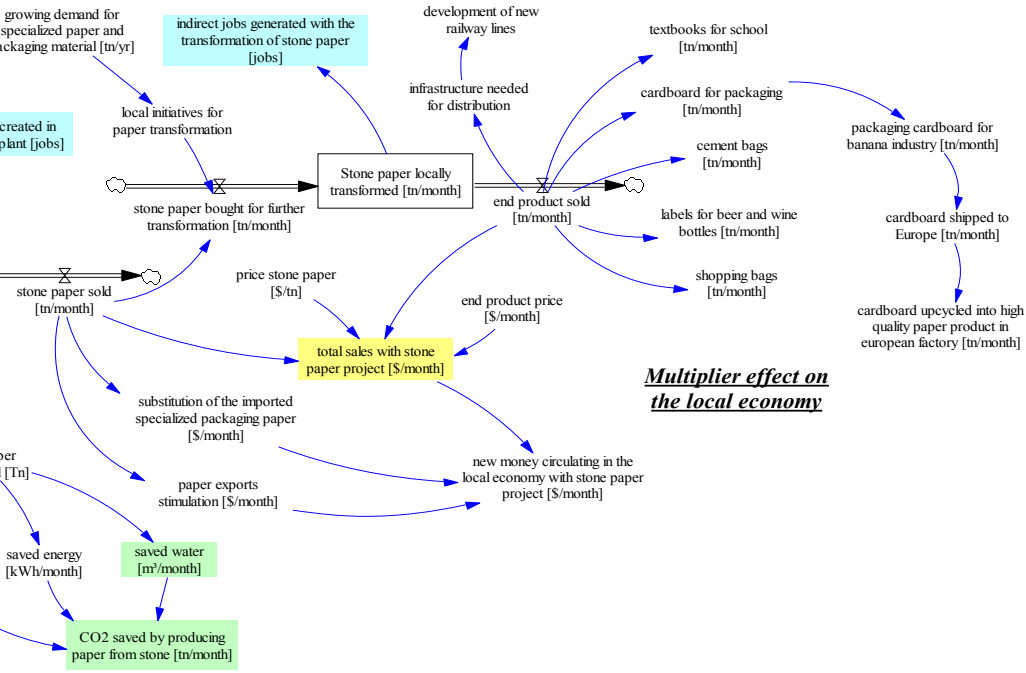
with polymers. Imagine manufacturing these banana cardboards from stone paper. The production of the paper cleans up the waste of mines in Argentina and when the boxes reach their destinations in Europe and the United States—the biggest importers of bananas—they can easily be turned into high quality paper for printing and other uses. And remember: No need for water; no need to plant trees. That's environmental efficiency!

The introduction of stone paper manufacturing provides governments with a radical new mining strategy that respects the environment while providing new economic development that provides community with long-term opportunities. Stone paper also makes it possible to protect forests and reserve more land for the production of more food. This is the way governments want to lead business: turning the disasters of mining into platforms for new industries that attract investors that generate more income for more people.

Plan A

Clustering mining with paper




growing demand for specialized paper and ackaging material [tn/yr]
indirect jobs generated with the transformation of stone paper [jobs]
development of new railway lines
textbooks for school [tn/month]
infrastructure needed for distribution
cardboard for packaging [tn/month]
created in plant [jobs]
local initiatives for paper transformation
packaging cardboard for banana industry [tn/month]
cement bags [tn/month]
Stone paper locally transformed [tn/month]
stone paper bought for further transformation [tn/month]
end product sold [tn/month]
labels for beer and wine bottles [tn/month]
cardboard shipped to Europe [tn/month]
stone paper sold [tn/month]
price stone paper [$/tn]
shopping bags [tn/month]
end product price [$/month]
cardboard upcycled into high quality paper product in european factory [tn/month]
total sales with stone paper project [$/month]
Multiplier effect on the local economy
substitution of the imported specialized packaging paper [$/month]
per [Tn]
new money circulating in the local economy with stone paper project [$/month]
paper exports stimulation [$/month]
saved energy [kWh/month]
saved water [m³/month]
CO2 saved by producing paper from stone [tn/month]

Fable 5

Stone paper

The first reaction to stone paper is incredulity. This innovation has been met with disbelief, and yet with a production capacity progressing to one million tons per year it is a reality. The investment costs are lower per ton than the largest mills searching the highest economies of scale, and the returns are a multiple of the most profitable cellulose paper mills today. And still, few see the opportunity and worse, hardly anyone has heard of this opportunity. This confirms that all too often ignorance is our greatest obstacle to innovation and transformation.

A monkey takes one stone after another and crushes them. He swings his hammer and pulverises each one until, after a long day of hard labour, he has a big pile of stone dust. An owl starting out on his night flight hovers around and hears the monkey say:

"That is the paper for the day."

Not believing what he has heard, the owl flies down and asks: "You say this is paper? You must be mistaken. These are stones, hammered to dust."

The monkey looks surprised and replies: "Oh, so how do you make paper?"

"Well," says the owl, "our paper is made from fibre. There are many fibres available, from fast-growing trees for instance, but the problem is they are taking all the food out of the soil and drink too much water."

"So what is your solution?"

"We are working with bamboo. You know it grows quickly, as it is a grass. You cut it; it grows again."

"And do you need any water to turn bamboo into paper?"

"Of course, making paper requires water, a lot of water. The good news is that bamboo comes with its own water."

"That's great. My stone paper, however, does not need any water at all."

"That can't be true! You may fool many people, but I tell you: paper is made from fibre and needs water."

"Well, it is time to think out of the box, you supposedly 'wise' owl."

"That is not very respectful, my young friend. Never in my life have I seen a single sheet of paper made without fibre."

"And never in my life have I come across such a stubborn monkey."

"Hey, could you show a bit more respect for an old owl like me?"

"Of course, if you could be open to new ideas – that have already been put into practice! By mixing stone dust with recycled plastic bottles and some chalk, I can make paper for writing and packaging; without cutting down any trees or wasting a drop of water."

"Paper that is tree-free and water-free?" wonders the owl.

"Exactly! This paper can also be recycled forever and ever, and all the land now used to grow trees can be used to grow food. It also creates many jobs, from bits of rock and stone, which are waste products."

"More farms, more fields growing food? I like that. It means more mice for me!" smiles the owl.

... *And it only has just begun*!

The Opportunity
"Glass Buildings"

250 units nationwide
15% ROI

Argentina could implement a glass recycling industry converting bottles and windshields into building materials, insulation and agricultural growth medium at half the cost today.

Europe built 11 factories over the past decade and has dedicated investment funds to finance the transformation of a non-destructable material.

Plan A

Chapter 5

Turning trash into cash: the transformation of glass

The recycling of glass is arguably with paper one of the most successful waste recovery programs in the world. About one third of all glass produced in the United States is recycled, the European Union on average recycles three quarters of used glass and Switzerland leads the world with a glass recycling rate of 98 percent. Countries like Argentina haven't even started impactful recycling programs—most used glass ends up in landfills or dumps—and may see the European recycling successes as distant dreams.

However, recycling of glass is not a big success; it is a missed opportunity and has been for decades. And Argentina has a chance to do something much more useful and lucrative with used glass. Here's the critical point: It does not make sense to crush a perfect glass bottle to make a new glass bottle. It's very costly to melt glass and then create the same thing with the same value. From an environmental perspective, that can never be a profitable business.

That's why the time has come to make a shift from recycling as merely a way to deal with waste and decrease the load on landfills to an investment strategy that is based on generating new value. Nature never recycles a product directly into the same product. No tree tries to recycle its leaves, keeping the foliage from the autumn to be re-attached in the spring. Instead, a tree drops its leaves, which are converted through armies of

species including earthworms, ants, fungi, and micro-organisms into humus, which feeds the tree again through the roots, blended with rain and bird poop. And every element contributes to the process that is never-ending.

This is a remarkable lesson in industrial ecology: Just like it does not make sense for the tree to recycle its leaves, it does not make sense to turn glass bottles into glass bottles. The tree passes through the humus stage before the nutrients are transformed into leaves again. Similarly, glass bottles are better converted into another material that is of great use to others on the market. We propose foam glass. Converting used glass into foam glass means turning waste into a structural material for the building industry as well as in a range of other useful products that add new, and higher value for agriculture, and for furniture manufacturing. Foam glass provides a compelling example how one product, by design and systemic use, can eliminate the need for several products. That creates a new dimension for sustainability as well as economic development.

Construction is—remarkably enough—from an environmental perspective the most destructive activity on the planet. To build something new and beautiful we first create a lot of damage and waste. The construction sector is a painful example of resource inefficiency. The sector is responsible for at least 50 percent of the total annual consumption of natural resources. The sector uses 40 percent of the energy that is consumed in the world and it produces between 40 and 50 percent of the total waste. The ecological footprint of building is immense. Every square meter of a new building requires 2 tons of raw materials and a lot of water and energy is needed to extract these resources. The energy necessary to build a house represents a third of the annual energy consumption of the family that will live in the home for the next 50 years(!).

In other words: There's an urgent need for new models and new processes in the construction sector to reduce waste and environmental impact and make better use of locally available resources. Foam glass presents an attractive sustainable alternative technology to build new

housing with high energy efficiency, exceptional health conditions and environmental quality.

Foam glass is not a new innovation. It was invented in the 1930s. Pittsburgh Corning in the United States has been producing the material for decades in large volume. That massive production scale would not serve Argentina well. The production efficiencies would be lost given the high distribution costs related to shipping—heavy—glass through a vast country. However, the technology is becoming increasingly relevant in a world looking for better environmental performance. Foam glass also allows for much smaller scale local production based on cheaply and readily available raw material. The production of foam glass cleans up waste and there's no need to extract anything from nature. Foam glass fulfills multiple functions and thus offers multiple services into one single product. This makes it possible to vastly increase material efficiency—exactly what is needed to improve both ecological footprint and return on capital.

Foam glass is made by crushing glass—used bottles and window glass from the auto- and construction industries diverted from landfills or collected from recycling points—into a "glass flour" that is subsequently heated and, at melting point, blended with CO_2 gas creating a bubbling foam. That means foam glass production captures CO_2 and contributes to fight against global warming while the process does not require any water. After cooling the mixture hardens into rigid porous blocks with gas-filled closed-cell pores comprising 97 percent of its volume. Therefore, foam glass is very light, but it is also very strong and that makes it a superior construction material. Because of the "trapped gas", the thermal and acoustic insulating capacity of foam glass is 20 percent higher than other insulating materials. Glass doesn't catch fire; it only melts at 1,100°C. Consequently, foam glass acts as a flame retardant as well. Glass is inert, making the proliferation of bacteria and fungus impossible, so this saves on the chemicals to keep a room free of bugs, reducing the risk of the respiratory diseases.

Plan A

The opportunity for a sustainable housing industry emerges with wooden or metal house frames "filled" with foam glass blocks made of reconditioned glass from bottles and windshield. The Swedish company Koljern has pioneered prefabricated housing systems based on foam glass. The excellent insulating capacity of foam glass makes the material especially fitting for colder or warmer climates. It also means that additional materials for insulation are unnecessary. That generates savings. More savings are realized because there's no need for toxic flame retardants in the house construction and foam glass provides excellent pest-control qualities as well while no molds grow on it. Finally, the material has a durability of around 100 years and, after that, can be recycled for 100 percent. Glass can always be recycled and reconditioned. It doesn't lose its value nor its functionality. In fact, it should be viewed as an asset on a balance sheet, not as a cost on profit and loss statement.

Foam glass offers more opportunities beyond construction material. It can be used as a growth medium for tomatoes and strawberries in greenhouses and hydroponic systems. The porous structure of foam glass offers soil aeration and the right water balance for the roots. The American company Earthstone has been manufacturing cleaning products from foam glass for 25 years. The abrasive "pumice-like" structure of foam glass allows to clean kitchen and bathroom sinks, toilets, and grills without the need to use toxic chemicals or sanding products. The Earthstone products help reduce strip-mining of pumice and other minerals used in many commercial abrasive products.

So far, Europe leads the foam glass market. In the past decade, 11 factories have been built—4 of these are operated by Misapor AG in "glass-recycling-champion" Switzerland. The Swiss even have an investment fund solely dedicated to this activity. Calculations show that a commercial factory can be sustainable and profitable with an annual intake of 5.2 million glass bottles. To get a sense of the potential of this new industry: the French and the Americans are the biggest wine drinkers in the world. They consume about 4 billion bottles of wine every year. That means there's an opportunity to build some 750 glass recycling

factories in both countries. Argentineans drink some 1.25 billion bottles of wine annually. That glass—that does not include any other bottles or the recycled glass from the car- and construction industries—is enough to successfully operate almost 250 factories in the country!

In reality, foam glass factories will be clustered around population centers. That's where the waste glass can be collected. A foam glass factory requires a population of about 50,000 people, an investment of 15 million dollars and can be built in about 18 months. The return on investment is estimated between 15 and 20 percent. It's important to note that a foam glass factory can produce various products—from building blocks for the construction industry to cleaning products for consumers. That means that risks can be spread. One factory can employ about 25 people. Indirectly, at least 2 to 3 times as many new jobs will be generated for the collection of used glass, in the construction industry and in the establishment of new industries like pre-fabricated housing, and hydroponic food production. The raw material of foam glass offers a new platform for entrepreneurship and will be able to generate employment beyond what the traditional glass industry has to offer.

Foam glass offers Argentina the opportunity to develop a prefabricated housing industry. Pre-fabrication allows for interesting efficiencies. The material is especially relevant in the area of Buenos Aires. Argentina's capital is located at a confluence of three rivers. Many people live on small islands in the vast estuaries of the rivers. Inundations happen frequently and, consequently, humidity is an ongoing challenge in the local housing sector. Concrete foundations are prone to mold affecting the living conditions and health of the population. Foam glass foundations solve that humidity problem. That makes Buenos Aires a perfect target for foam glass factories. Not only is there plenty of glass waste available, the conditions of the construction market are also ideal for the introduction of this product innovation.

Tierra del Fuego in the deep South of the country also provides a great opportunity for foam glass. Not only has the local government recently introduced a glass recycling program, Tierra del Fuego's distance from

Plan A

Argentina's heartland makes local construction material production a very good investment. Today, construction materials need to travel 3,000 kilometers from Buenos Aires. The local government has even concluded that shipping the collected used glass to a recycling facility is too expensive. Building a foam glass factory solves both problems at the same time: the collected glass can be locally reconditioned and the need to ship building materials to Tierra del Fuego from far away decreases substantially.

Another opportunity arises in the wine country around Mendoza. The city has a population of 115,000 people. That is a perfect size for a foam glass factory. However, the wine makers of Mendoza produce some 150 million wine bottles per year and 1 percent—or 1.5 million bottles—is usually discarded because of production errors. That waste is perfect raw material for a foam glass factory.

Furthermore, Argentina will benefit from this new industry because locally produced foam glass will contribute to the reduction in the import of insulation materials. The production of foam glass is a perfect example of the opportunity to turn trash into cash. Today, used glass ends up in landfills. That "waste" can be used to creating healthier living environments as well as healthier cleaning products for consumers.

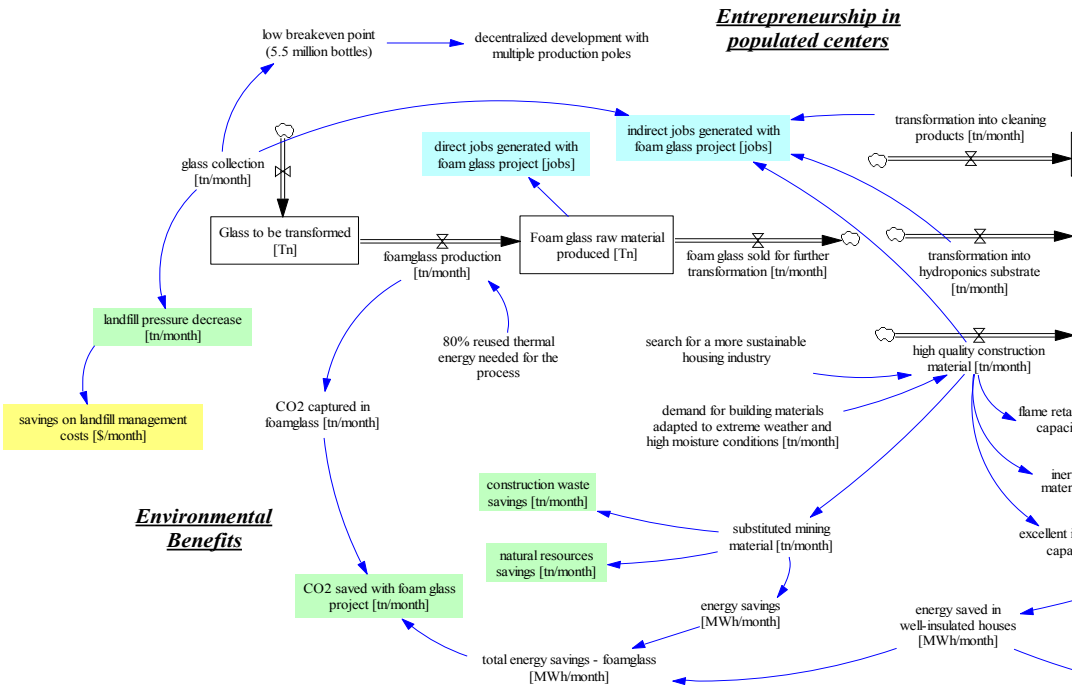
Glass is a resource and it is timely that Cerveza Quilmes, Argentina's leading brewery recently reconfirmed its decision to only bottle beer in glass and to skip the world trend of aluminium packaging. The brewery did not even realize that that decision means supporting the housing sector in the country! That is the new economy where clusters of industries support each other.

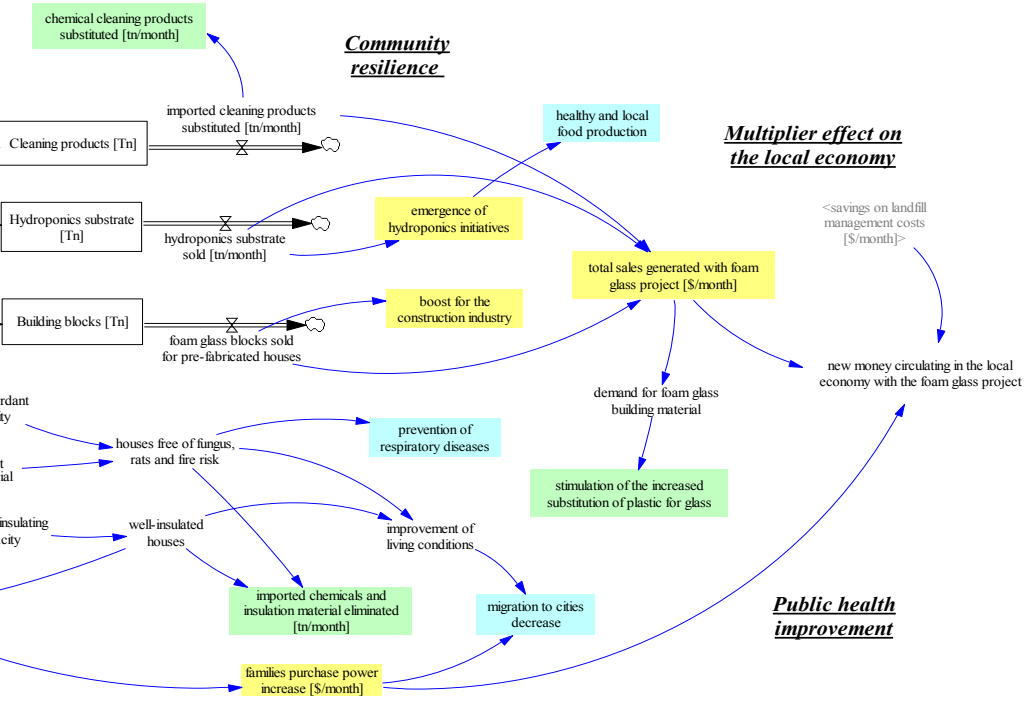
In an old-fashioned life-cycle analysis glass loses from plastic. Glass is heavier and that leads to higher distribution costs. The soft drink company only sees the bottle and the opportunity to cut expenses by choosing a lighter container that needs no subsequent handling. That decision pushes the waste onto society while communities lose the opportunity to generate value, income and employment.

In a wider systems approach, glass beats plastic by a multiple—even if its biodegradable—in any life cycle analysis. Foam glass reduces the use of natural resources and energy. Every ton of foam glass saves a ton of resources through mining. Glass is mined from sand once and can be used—and add value—forever.

That's a different kind of sustainability that is focused not just on the impact on the environment but on people as well. A home provides more than a roof. Housing is even more sustainable when it supports the health of people. Healthier living supports better opportunities for education and employment. The inspiring message is that one simple decision to value glass has a deep positive impact on many parts of society.

Clustering packaging with construction




chemical cleaning products substituted [tn/month]
Community resilience
imported cleaning products substituted [tn/month]
Cleaning products [Tn]
healthy and local food production
Multiplier effect on the local economy
Hydroponics substrate [Tn]
hydroponics substrate sold [tn/month]
emergence of hydroponics initiatives
<savings on landfill management costs [$/month]>
total sales generated with foam glass project [$/month]
Building blocks [Tn]
boost for the construction industry
foam glass blocks sold for pre-fabricated houses
new money circulating in the local economy with the foam glass project
demand for foam glass building material
houses free of fungus, rats and fire risk
prevention of respiratory diseases
stimulation of the increased substitution of plastic for glass
well-insulated houses
improvement of living conditions
imported chemicals and insulation material eliminated [tn/month]
migration to cities decrease
Public health improvement
families purchase power increase [$/month]

Fable 6

The crystal palace

The key to transformation of an economy is the identification of new value in and around products and materials that are readily available. Glass is already separated, and can be easily transformed with great profit and margin for business, society and nature – not into a bottle – but into functional products that dramatically increase the overall efficiency of the economy. It is not a recycling program, it is the design of a cluster of activities that responds to everyone's needs with cheap and available resources.

A flock of seagulls is working its way through a mountain of waste. Truck after truck delivers more waste from the city.

"It is astounding what people throw away," squawks one. "There is so much that should never end up here. And it is even worse, at sea, where fish and birds make the mistake of taking plastics for food."

"Yes, just look at these millions of plastic bottles," says another.

"I don't understand how people could ever have been fooled into believing that plastic is better than glass," adds a rat who lives in the same area.

"You never went to school – I can tell," answers the first seagull. "I learned there that plastic is light and glass is heavy. So you can carry more in a plastic bottle."

"But what can you do with bottles lying around here?" wonders the rat.

"You could make new bottles." The young seagull puffs out his feathers, happy with his answer.

"Have you ever seen leaves drop from a tree in autumn?" asks the rat.

"Of course, again something you do not need to go to school to understand," scoffs the seagull.

"But have you ever seen a tree in spring time, reattaching the leaves it dropped way back in autumn?"

"Now don't be ridiculous. We know that does not work, and if it ever were to work it would cost a lot, be inefficient and would never look good."

"So if the tree does not make leaves out of leaves, why do you want to make bottles out of bottles?"

"Uhm, because I was told so", confesses the seagull.

"You believe everything they tell you? Let's put our heads together. Let's do better", says the rat.

"Sure, I'll give it a try", promises the seagull .

"What happens if glass melts? And what happens if plastic melts?"

"Well, plastic burns, creating black smoke that smells terrible. Even worse, it is bad for you and me."

"And glass?"

"Glass just melts and if there is a lot of gas around – which we do have – then it turns into foam."

"And what do you do with foam glass?"

"No idea!"

"Think again – is it heavy?" asks the rat.

"No …"

"Can you bite into it?"

"I don't want to. Can you?"

"No – if I try I might lose my teeth", answers the rat before continuing with his questions by asking: "Does it allow water through?"

"No."

"Can you sit on it?"

"Yes, it is strong!", The seagull nods, happy to know the answer.

"And if you crush it to pieces, what can you do with it?"

"Well, glass cannot be destroyed, only transformed", answers the seagull.

"It looks like we could build a house out of this!" exclaims the rat.

"Well, now I have to go back to school and teach everyone to use much more glass so we can have our crystal palace!"

... *And it only has just begun*!

The Opportunity
"Wild Yeast"

10% growth
Captive Market

Argentina is home to one of the richest biodiversities of wild yeast. This high growth market for beer, wine, bread, ethanol and animal feed is increasingly demanding natural yeast for product diferentiation.

Argentine has the core science, but not yet (!) the entrepreneurs to respond to the 100,000 craft and micro-brewers in the world. It could turn into a financing tool for National Parks.

Plan A

Chapter 6

A wealth of yeast in Patagonia

The vast and sparsely populated plains of Patagonia—that Argentina and Chile share—offer an abundance of nature. The region comprises the southern section of the Andes mountains and stretches from the Pacific Ocean in the west to the Atlantic Ocean in the east. Situated between high mountains and two oceans, Patagonia offers a wealth of biodiversity. Many visitors marvel at the expansive beauty of Patagonia. They see the plushy animals, the shiny birds, the surprising insects and the wealth of plants, and yet there is so much that remains unseen to the human eye.

However, few people are aware that Patagonia, jointly with the Himalayas, offers the richest variety on the planet of a tiny organism that plays a critical role in our life: yeast. Without yeast our lives would not be the same: we would have no bread, no sanitation, no conservation, no fermentation, no beer or wine, kimchi or tofu. The thousands of yeasts that thrive in Patagonia offer Argentina a unique opportunity to generate economic development with a resource that is readily available for free.

Yeast are single-celled micro-organisms that are classified, along with molds and mushrooms, as members of the Kingdom of the fungi. They are (almost) invisible and hang around trees with ripening fruits and on the bark of oaks. Early civilizations discovered that yeasts could trigger fermentation, that is converting carbohydrates into carbon dioxide and alcohol. The process of fermentation sanitized food and cleansed water. Today, we may associate beer with alcohol, but the original use of beer was

as an alternative for disease carrying germs water. The ancient Egyptians used yeast fermentation to leaven bread and that dramatically increased digestion. Yeast has long been used as well to ferment grapes into wine.

There are over 1,500 species of yeast know to scientists. There are many more that have not been studied yet. When the season is right, traditional beer brewers in Belgium open up the roof to "harvest" the yeast they use for fermentation. The British company Cara Technology offers the food and beverage industry some 800 varieties of yeast that it has collected in the world. However, today, most yeast is produced in labs in standardized genetically modified processes that ensure predictable flavors and tastes. And society has mostly lost the richness of the diversities of yeasts and the wealth of flavors and experiences they can produce.

But more and more people are looking beyond standard products to exclusive experiences. Yes, beer multinationals control most of the market. But in every city, there are micro-breweries offering a beer-drinking experience that is not standard but local and unique. There are 1,000 and counting micro-breweries in Argentina. There's a big wine culture in the country as well. And a vast majority of the yeast for all these drinks is imported while Argentina possesses the world's largest reserve of yeasts with over 1,000 varieties in Patagonia!

Argentina has a major opportunity to become one of the world's number one supplier of the yeasts that can create diverse and unique flavors in wine, beer, bread and more across the globe. To illustrate the emerging trend: in collaboration with the scientific network, COCINET, Heineken recently launched a new exclusive beer with a limited edition that—according to the label—is fermented with the wild yeast from Patagonia. This initiative shows that knowhow to use yeast varieties for large-scale production is available. The next step is the establishment of a network of citizens, biologists, scholars, students, nature lovers who in collaboration with local laboratories that harvest the yeasts. That network will be the basis of the development of inventory build-up with the exact location of where in nature the yeast was found. This leads to a distribution and export program to enrich the dynamic micro- and craft brewing industry

that already has more than 100,000 operations worldwide (65,000 in the US alone) with native yeast species from the Patagonian wild that can even be traced to specific areas.

Science makes it possible to identify yeast sources with great precision. That means that it is possible to prevent "biopiracy" by commercial companies who have taken the liberty to collect under the cover of science or ignorance endemic yeast species. These companies "steal" yeasts and make money selling it without any retribution or even recognition to the ecosystems that host these unique living organisms.

Decades ago Esprit-founder Douglas Tompkins and his wife Kris began buying vast areas of land in Chile and Argentina to restore the environment and return it to the governments as national parks for future generations. Today, the development of a micro yeast industry makes it possible to create an income stream to maintain that precious nature: the opportunity arises to bring science and entrepreneurship together to preserve these last tracks of primary rainforests. The re-emerging story of yeast offers many other experiences as well. It provides opportunities to re-connect children with nature and educate them about food and how they can create resilience through making their own food. Bread, beer and wine are in every home of every Argentinian, and most citizens of the world. This is a way to bring biodiversity and the economic value of preservation of the ecosystems to every Argentinean.

"Yeast safaris" can be a new offering in ecotourism. Tourists will go out into nature and map and catalogue yeasts bringing art and science together. "With yeast from Patagonia" can become a new "trademark" and strengthen the Argentina "brand" in the world. And a 2 percent wilderness tax on all beer, bread and wine produced with wild yeast from Patagonia could generate a massive revenue stream to conserve primary ecosystems that are under threat.

The yeasts of Patagonia offer an innovative economic model. National Parks, that feature on the list of expenses for the common good of the government, become a source of substantial revenue. Yeast sells for 25 dollars a kilo. There are ready markets of beer brewers and wine makers

that can be supplied and is very keen to buy. The artisanal beer industry in Argentina has been growing at an annual double digit rate for a while with no signs of deceleration. After years of consolidation of the industry, there is a clear trend towards local and small scale production with a wealth in creative design of beer.

There is no replacement for yeast. The global yeast market is to grow by 2022 to US$ 11 billion. Argentina should aim to take 10% of the market. Apart from beer, wine and bread, the increased use of yeast in animal feed and ethanol production is driving the global expansion of the market. Demand for yeast for biofuels is to rise at double digit rates. The global beer yeast market is also projected to grow with nearly 10% through 2022. These are ideal conditions to take a position on the market with a unique label "Wild Yeast from Patagonia".

The main ingredient to produce yeast at an industrial scale is molasses. Argentina produces large amounts of sugar cane (1.9 million tons) and Argentina has 15 ethanol production units. The combined demand from ethanol, wine and beer industries warrants a captive home market where there is a chance to take market share from the handful large producers like Lesaffre, Lallemand, DSM, ICC and Oriental Yeast.

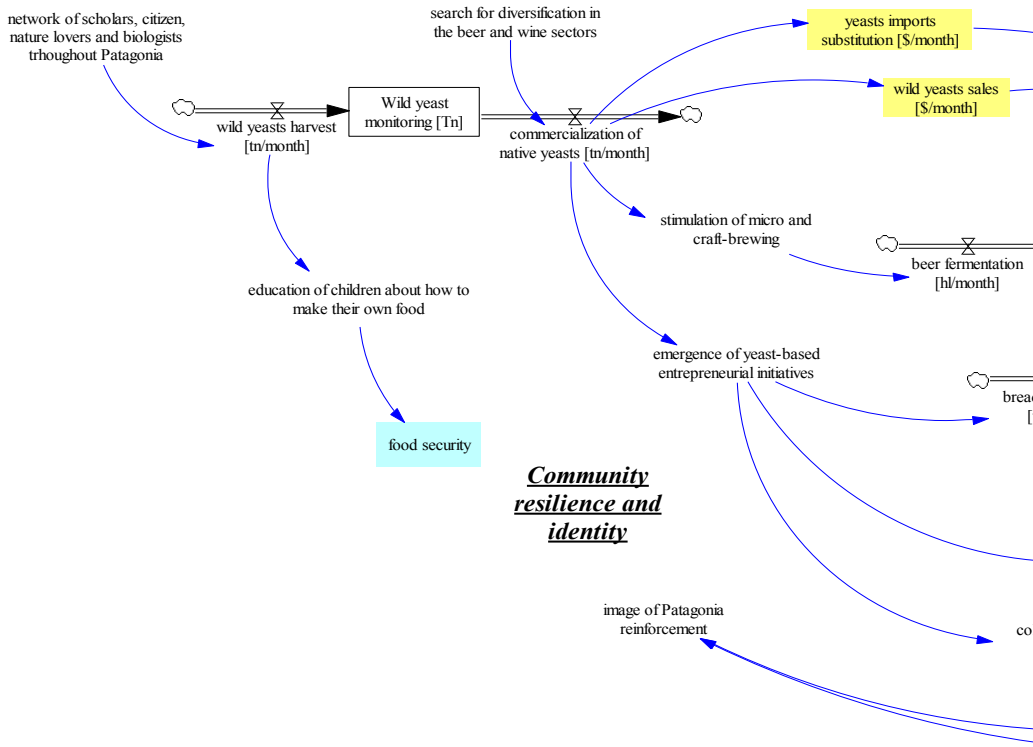
As a first step, Argentina has decided to invest in a laboratory to study yeasts and to provide education and training to brewer, wine makers and people in the food industry. It has experts like Dr. Diego Libkind who has created the first maps and even discovered the ancient mother cultures of European lager beer tracing it back to Patagonia. There is a remarkable story to be told, and there are millions prepared to listen, and buy.

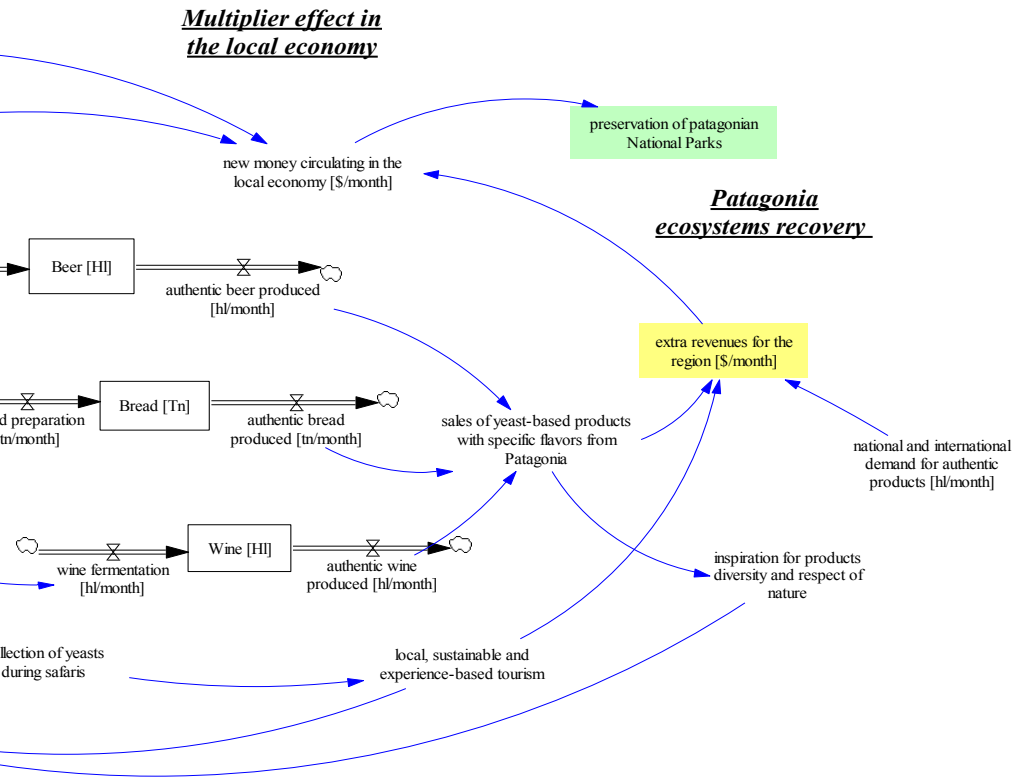
It is a small investment to create more awareness that will support the opening of a vast new market that can be valued at one billion dollars a year. The experts agree, the Andes mountain range has the right image to turn this into a strong business case. The collection can be based on thousands of entrepreneurs, the purification can be based on dozens of local production units, but the brand and name recognition of Patagonia is already solid in the world, it is up to investors to turn this into a competitive industry.

The (still) abundant ecosystem Patagonia will continue to harbor wild yeasts for free. The opportunity for Argentina is to offer this variety to the world to inspire more diverse flavors generating new income and economic development while saving money on imports, and generating a stable revenue for the National Parks with products that are common in every household around the world. It will energize a new generation and instill a respect for nature thanks to the small and invisible biodiversity.

Plan A

Clustering Yeast with beer, bread and wine




Multiplier effect in the local economy
preservation of patagonian National Parks
new money circulating in the local economy [$/month]
Patagonia ecosystems recovery
Beer [Hl]
authentic beer produced [hl/month]
extra revenues for the region [$/month]
Bread [Tn]
authentic bread produced [tn/month]
sales of yeast-based products with specific flavors from Patagonia
national and international demand for authentic products [hl/month]
wine fermentation [hl/month]
Wine [Hl]
authentic wine produced [hl/month]
inspiration for products diversity and respect of nature
during safaris
local, sustainable and experience-based tourism

Fable 7

Small but powerful

Yeast is part of every day's life. Just like ecosystems depend and the small and nearly invisible, modern today society learned millennia ago about the power to transform a raw material that is hard to digest, into a nutrition that brings health. The capacity to create value through fermentation with yeast brings economic benefit. However, the yeast itself also generates major opportunities to strengthen the awareness of nature and its biodiversity beyond plushy animals and colorful plants, to generate jobs and finance the natural parks with resources that are endogenous and yet unexploited. Yeast is probably one of the only resources that can be harvested and multiplied without ever depleting it, provided the ecosystem remains thriving.

A small owl is watching the rain fall in the beautiful valleys of Patagonia. The forest is wet, but the smell is fresh. There is something special in the air. Then, the owl spots a mara hopping around the bush.

"Are you a rabbit or a kangaroo?" wonders the owl.

"What continent are you calling home?" responds the mara.

"This is Patagonia, the land of space, plenty and beauty."

"Well in that case I cannot be a kangaroo." snips the mara.

"Maybe you are not, but you hop around like one."

"Look I am a mara, and I may look like a rabbit, and hop around like a kangaroo, but just forget both, I am original and natural called a mara."

"Sorry, but hardly ever have seen you. There must be only a few of you around. What happened to the rest of the family?"

"Killed!"

"Oh I am so sorry."

"Don't feel sorry about me. I feel sorry about you. You must be a dwarf owl. Did you parents not feed you?"

"People call me the pygmy owl, a tiny winy bird that was destined to look like a miniature version of the big brothers. But I have a big tail."

"And what do you eat?"

"Mice, lizards, small birds and occasionally an earthworm."

"We both live in a wonderful world called Patagonia."

"Not only do we love to live in this world, we share this world with some wonderful friends."

"Who is your best friend?"

"Maybe it is not my best friend but it is my smallest and most powerful friend: I adore all yeasts in this forest."

"Yeast, you got to be kidding! That tiny invisible stuff that hangs around ripening fruits, and nestles on tree bark. It could even make people sick?"

"I admire this too small for the human eye to be noticed that makes our beer, wine, and bread so tasty."

"You really have no better choice to put on a pedestal?"

"So small yet so powerful. Wild yeast turns juice into wine, barley into beer and dough into bread. We can go and catch it on a yeast safari."

"Wow, it is about time I figure out what great stuff I can do for this world."

"Why do you want to find out what you can do? Why don't you figure out what you can do together with yeasts. There are thousands around and each one can do the magic for you!"

... *And it only has just begun*!

The Opportunity
"Vicuña"

$25 million/year
9 Native Communities

Argentina has an emerging success story in the management of CITES protected species. The vicuña is in high demand, and with 30 tons illegally traded, there is a window to fill demand and build a strong brand for Argentina.

One vicuña generates 100 times more income than one sheep. The direct connection with clients creates opportunities for ecotourism creating a multiplier effect of four. Mongolia demonstrated the effectiveness of this strategy with cashmere.

Plan A

Chapter 7

The Wild Fibers

The clothes we wear are either made from farmed fibers— cotton and wool—or from synthetic fibers—nylon and many others. This textiles market is dominated by a few big players that are able to operate within very small margins but thanks to their enormous volume generate huge profits. In this stressful environment, smaller players like Argentina—despite their historic market presence and the millions of sheep in Patagonia—can't successfully compete. However, Argentina has an opportunity to make a unique contribution to the high fashion market while serving its indigenous cultures and communities. The country has access to wild fibers of an exceptional quality that can be obtained rebuilding the traditions that have been thriving in the Andes for milleniums. Wild fibers offer a very high margin and the emerging industry maintains and regenerates fragile ecosystems. It seems too good to be true but field visits and detailed follow-up with the communities offered a remarkable insight in these opportunities to transform the business models for generations to come. This is not a hit and run opportunity, rather it requires care and design, but the impact will be lasting.

A very high market concentration opens opportunities for high-quality, niche players that offer a higher value with respect for tradition and culture. We can draw a parallel between the textiles business and the drinks industry. Most beer in the world is produced and sold by a handful multinational breweries. However, there's an inspiring trend of micro-breweries/cafes that come up in every modern city. Similarly, there

are a few giant textile players and now there's an opportunity in the global market for products that add a different, local flavor and style at a premium price. Top brands and designers are looking for different fabrics to create exclusive fashion. And, in their search, they have come to the highlands of Argentina where for 10,000 years a not so well- known animal, the vicuña, has lived in symbiosis with local mountain communities. Today, the wool of the vicuña is the most sought-after in the world. The vicuña offers Argentina a unique economic, social and environmental opportunity provided it changes the business model of export of raw materials, and strengthens the communities to rediscover their skills and affinity with the fiber, the vicuña and its ecosystem.

A century ago, the world textiles market consisted only of farmed natural fibers: mostly wool and cotton. The invention of nylon in the 1930s was the beginning of a major transformation of the market. Gradually, natural fibers lost their market share as the new synthetic fibers were easier and cheaper to produce, wash and dry. Today, synthetic fibers hold almost 65 percent of the world market. Natural fibers share the remaining 35 percent with cotton holding the lion share with 25 percent. Wool has a marginal 1 percent of the world market. And one hundred years ago, one million tons of silk was sold each year; today the world silk market is less than 100,000 tons.

In the past 10 years, the market underwent another transformation with fashion becoming increasingly dominated by cheaply and quickly produced cotton clothing that is only briefly used until the next fashion wave hits. This trend is led by global brands as Inditex (Spain), Hennes & Mauritz (Sweden) and Bestseller (Denmark).

"Fast fashion" is dramatically increasing the environmental and social burdens caused by the fiber industry. The production of both synthetic and natural fibers poses a huge environmental challenge because of the massive amounts of water being used. For example: The conversion of each kilogram of cotton seeds into fiber requires a staggering 2,000 liters of water. Moreover, cotton is highly dependent on chemicals. According to some estimates, cotton consumes as much as 20 percent of the pesticides

applied to crops worldwide. Worst, only 50 percent is converted in clothing, the rest is wasted. In other words, the cotton production drains water resources while it pollutes water systems with toxins at the same time, while demonstrating a low material efficiency. Organic cotton takes the toxins out of the production, but even in that case the water consumption, the color pigments, and the fixing agents remain problematic. It's not surprising that the United States of America, once the largest producer, has resolutely decided to reduce its farming of cotton simply because it does not have the water anymore.

The aggressive drive by global fashion brands to lower prices has not only concentrated the cotton production, it is also forcing production countries to undercut (child) labor standards. China and India lead the market and together produce 60 percent of the world's cotton. Smaller players like Indonesia, Bangladesh and Pakistan are able to maintain a market position. Other countries, like Argentina, struggle to successfully compete in these stressful circumstances of ever lower unit prices for ever lower quality products. Alternatively, the production of synthetic fibers requires large-scale investments related to the fossil fuel industry as well as easy access to large consumer markets. Argentina does not seem to be well-positioned for that industry either.

Finally, there is the wool market. The sheep of Patagonia— once introduced by the Spanish colonizers—provide some 4 percent of the world wool production of 2 million tons. But wool is not very popular in today's fashion industry and there are few sheep farms that are doing well. Sheep wool sells for about 3 dollars per kilo. That leaves very little margin for the herder and economies of scale do not seem to add to the overall position of wool in the world market, even though niche players like the Norwegians succeed in maintaining their wool with great national pride supported by a local market ready to pay extraordinary premium prices and a government ready to subsidize generously.

The general conclusion is that producing fibers for the textile industry doesn't offer production countries interesting opportunities to add value

to support local economic development. The oversimplified approach to production in ever-higher volumes has led to a situation where cost-cutting and budget controls determine everything. Operations are focused on offering ever-cheaper products with ever-better margins for the intermediaries without considering the full impact on the health and the lives of people and their environment.

Here's an example: If you wear a fine, soft cashmere sweater, you are likely contributing to the desertification of Mongolia. The country produces 40 percent of all cashmere through herding goats in the fringes of the savannas around the Gobi Desert. However, the cashmere production doesn't help Mongolia. When you buy a cashmere sweater online, PayPal—a financial software system—earns as much on the sale for securing the payment as the herder does for accompanying his animals all year.

The only way for herders to survive—they are made to believe—in these circumstances of rising demand and limited space is to cut costs where they can. The simplest way to increase revenues is by owning as many goats as possible. That will bring down the overhead expenses for washing, spinning, dying, weaving, sewing, and selling the wool. So, the number of grazing goats increases in Mongolia's fragile savanna bordering dry lands, and the desert expands. There is a direct correlation between the livelihood of the herders and the degradation of the ecosystem. More goats may temporarily increase the income of the herders. But the fashion chains will keep pushing the prices down to attract higher consumer demand and desertification continues. It is a predictable recipe for disaster.

Nature can only be maintained and regenerated when the livelihood of the herders is first secured. That means substantially raising the price, the herders receive for the cashmere. Experiments in Mongolia show that herders can substantially increase their income when a model of vertical integration from wool to wear is introduced. In that new experimental model the farmer gets 10 percent of the price of a sweater paid by the customer. The farmer directly participates in the success of the quality of the product. Such a model transforms the production from delivering a commodity to creating products with high value. The new model allows

the herders in Mongolia to generate more income with fewer goats. This takes pressure off the environment, permits nature to restore itself and puts a human face on the final product. The market is hungry for this level of personalization.

Vertical integration may not seem efficient according to the doctrine of standardization, but it does permit differentiation. It also increases opportunities for local artisans to add creativity and cultural dimensions to produce desirable fabrics and clothing. A fully integrated value chain offers a broad opportunity for craftsmen and women to contribute with their unique skills and earn a major share of the revenue, which can start to circulate in the local economy, spurring growth beyond what is considered viable by traditional market economists.

The Mongolian cashmere example inspires an opportunity for Argentina. The country has well-known domesticated animals that contribute to niche markets with their wool. An even greater opportunity arises for two other —lesser-known— members of the same camelid family: the vicuña and the guanaco.

The vicuña lives exclusively in the high mountains of the Andes. The guanaco lives in the mountains as well as in the lower lands of the Pampas plains and Patagonia. Their presence maintains the balance and quality of fragile ecosystems. However, these wild animals have lived in symbiotic relationships with the traditional cultures of the Andes countries (Bolivia, Peru, Chile and Argentina) for thousands of years. That harmonious relationship provides a unique opportunity since their wool provides fibers of an exceptional quality. The wool of the vicuña provides the finest, most sought-after fiber in the world and is in high demand of leading international fashion designers. The fibers of the guanaco have similar exclusive quality but the wool is still over- shadowed by the vicuña and the alpaca. It is less known and does not carry the exclusive brand name that vicuña has acquired.

The downy undercoat—the fleece—of the guanaco and the vicuña makes extremely warm wool that outperforms cashmere in softness. The

wool is separated from the hairs, spun into yarn and knit or woven into luxury garments. That extreme softness is caused by the small diameter of the fiber very close to the skin of the animals. In an intricate process that downy undercoat is separated from the rough overcoat. The wool of the animal's overcoat could be used for carpets, soft and hardy produced through living in extreme climate.

The vicuña and the guanaco have never been farmed because they do not permit themselves to be domesticated. They maintain themselves grazing the land. They don't need to be fed or otherwise taken care of. That means that they can provide their "wild fibers" at the cost of harvesting. It also means that, until recently, hunters (and poachers) simply shot the animals to get their wool. An estimated 30 tons of poached materials finds its way to the world market.

Unfortunately, recent growth in the guanaco population has created a competition with sheep. These precious guanacos are chased away and even killed to make space for sheep since the wild animals were grazing "too much". As a result, the vicuña is included on the list of endangered species of the Convention on International Trade in Endangered Species (CITES) and the guanaco figures on the red list of endangered species of the International Union for the Conservation of Nature (IUCN).

Any economic initiative with the wool of the vicuña and the guanaco needs to demonstrate proper management of the species. To capture the animals, villagers organize *chakus*, gathering techniques with hundreds of people driving the animals towards portable fence structures that can be set up in places where the animals are optimally concentrated. The wild animals are funneled into a central corral where they can be shorn. It takes about three minutes to shave the animal once blinded as to reduce the stress, and they can be quickly reintegrated in their wild environment. The process requires diligent care to respect animal welfare and to minimize the risk of any incident. This is also critical because the CITES protection prevents any export of products that are related to harming endangered species.

Peru and Bolivia are showing that they can produce 40 to 50 tons of

vicuña and guanaco fleece per year with minimal investments. That is not a huge quantity. Ecuador has reintroduced the vicuña. A vicuña produces only 200 grams of fleece fibers every two years. However, raw vicuña wool gets the highest price of fiber in the world with 500 dollars and more per kilo. To put that in perspective: The market price of vicuña wool is almost 10 times higher than the price of cashmere, and more than 100 times higher than wool from sheep. That means that the vicuña offers an opportunity for economic and social development for often very destitute communities in the highlands of Argentina.

The communities can add more value with traditional craftsmanship. In addition to the preliminary cleaning of the fiber, fabric designs integrated with silver and leather can be created. The guanaco wool has nearly the same softness but lacks the fame of the vicuña which opens the door to promotion and marketing.

At present, the local communities don't fully benefit from the unique opportunities that particularly the vicuña wool offers. The raw material is purchased by Italian designers often at below market prices of only 350 dollar per kilo and the added value of the production of fabrics and clothing is only produced abroad. The communities of the vicuña lands in the Andes don't have direct access to the world market.

Our initial objective is for Argentina to develop first a domestic market for vicuña wool that the highland communities can serve. Further down the road, there's an opportunity to connect the local producers with international customers ensuring—like in the example of cashmere from Mongolia—that the value is created and realized where it belongs and can have the most impact. The income of the artisan producers should be linked to the final sale price of the products, not to the weight of the fabrics they produce. This is major shift: instead of selling kilos, one sells the extraordinary experience of products that last for more than a generation.

This is the anti-thesis of fast fashion. The good news for these Argentinean communities is that the extraordinary quality of the vicuña wool presents the perfect conditions for a supplier's market. There is substantial

unsatisfied international demand. In fact, the Hermes Foundation based in Paris and funded by the family-controlled high-fashion company has a broad experience in supporting the development of production in the local communities building on age-old and time-tested traditions.

The development of the small-scale industry requires limited investments in the *chaku,* for the animal capturing structures. The missing link are the local spinning facilities. The vicuña and guanaco fibers are very soft but also very short. That means they need to be processed in a non-static environment. Traditionally the yarn is manufactured following ancient techniques with simple, not very expensive, wooden spinning instruments.

Five years ago, there were only 100,000 vicuñas left in Argentina. However, their numbers are rising. It is estimated that there are now some 300,000 vicuñas. That means that 100,000 vicuñas can be shorn each year and at an average of 200 grams of fleece wool per animal, the annual harvest can be 3 tons.

On the other side, there are 6 millions guanacos in Argentina and they can potentially provide 400 tons of wool per year. The initial focus is on 600,000 guanacos that can provide 40 tons of wool per pear for an income of up to 20 million dollars. To that, add another 5 million for the quality fleece produced and transformed by the local communities in the North of the Province of Jujuy.

Between the vicuña and the guanaco Argentina could produce wild fibers for some 25 million dollars in revenue. That amount can rise when more value is added locally and when the numbers of the animals increase. Still, the projected income doesn't change much in the mindset of government offices in Buenos Aires where this initiative may be considered too small to deserve high level attention. However, it has the potential to transform 9 native communities at 4 to 5,000-meter altitude in the high mountains bordering Bolivia. Especially, when we realize that the restoration of a traditional culture and local economy can be a starting point for new activities.

The highlands of Argentina offer exceptional natural beauty—unique

rock color formations, and sub-soil glaciers—that few people have been able to appreciate. With the distribution of the fine vicuña wool through the high-end global fashion market, an interest in the region of origin can be developed. Every piece that is produced links back to the highlands where the vicuñas roam. The investment in this exceptional product is converted into an opportunity for private "vicuña safaris". Eco-tourism with respect for local environment and communities can kickstart a multiplier effect with the initial revenue of 25 million dollars of the vicuña (and guanaco) hair turning into a 100 million dollars travel industry bypassing the income generated today by the wool industry.

That development also supports the environment. Without new and better opportunities, the local population has ventured into cow farming that has been sold as a "safety deposit" as there's always a very good demand for Argentine meat that has roamed freely in the highlands. However, cows are too heavy for the fragile soil on top of the underground glaciers, which suffer from the urine. That means the glaciers which are already under stress from climate change will disintegrate even faster and that process releases massive amounts of methane the greenhouse that has about a 21 times bigger global warming impact than carbon dioxide.

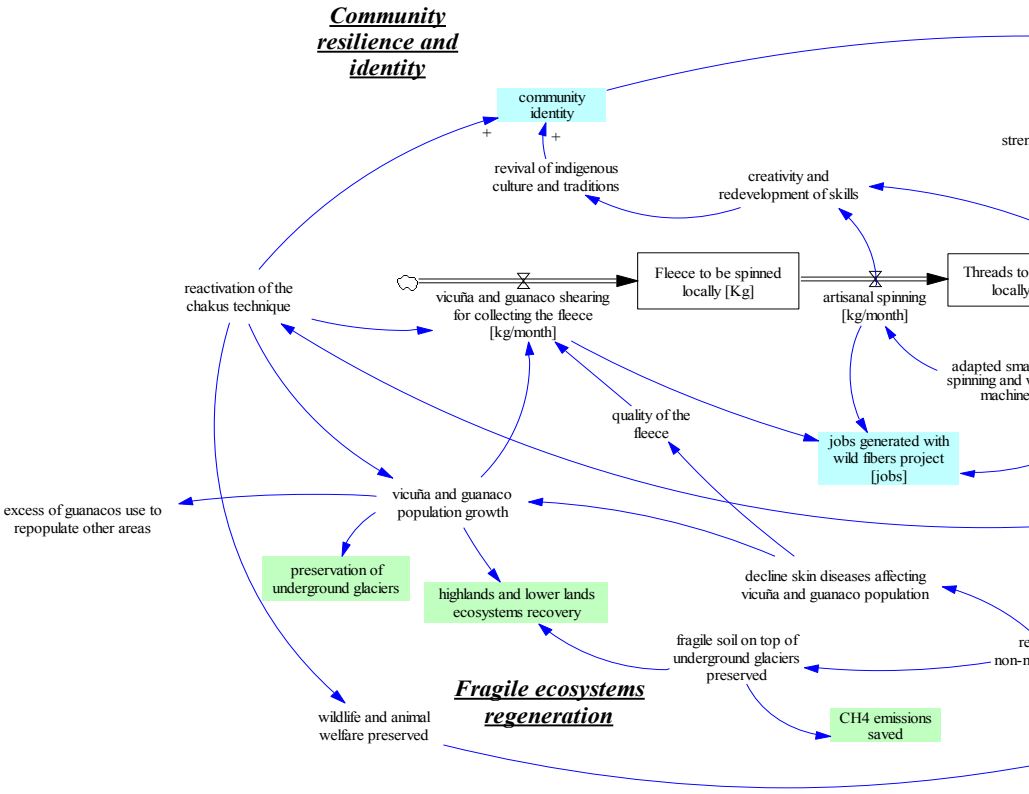
Cows do no only cause the erosion of the soil as they trample, but also they transmit skin diseases and could affect the quality and the long term harvesting of vicuña wool. The native vicuña, on the other hand, sustains the ecosystem.

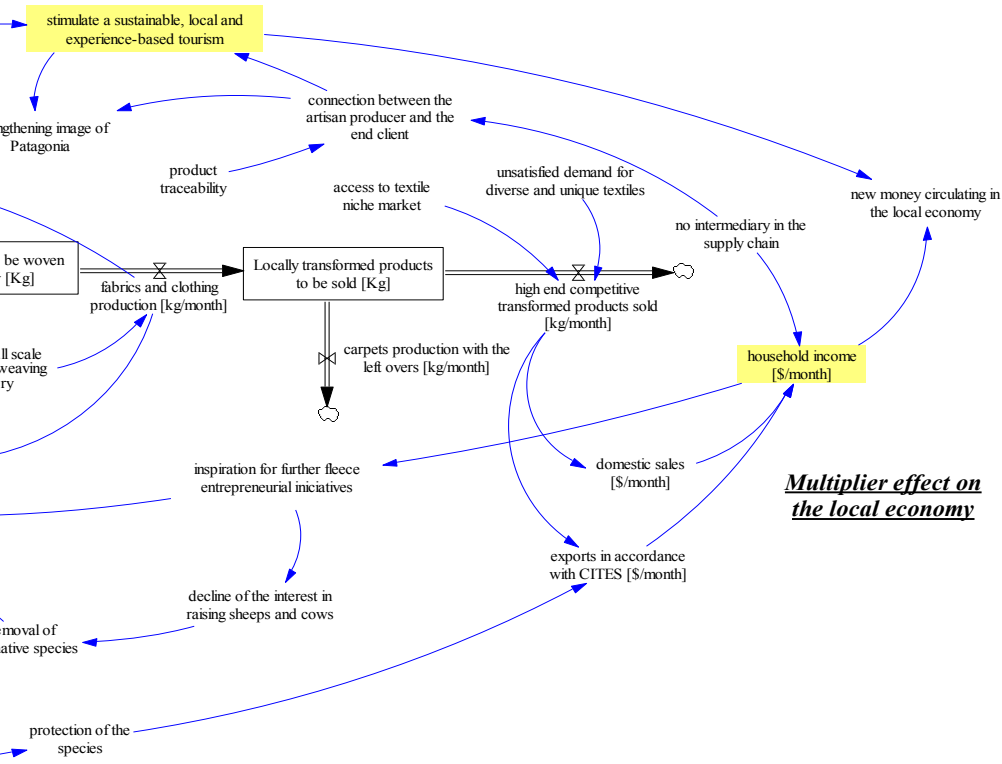
A better local economy around the vicuña allows for the removal of cattle from this vulnerable ecosystem. And there's an opportunity to regenerate the herds of vicuñas. In the past, the vicuña was sacrificed for short-term gain whereas the guanaco was killed for meat. Today, Argentina has a great opportunity to regenerate of the ecosystem goes in this case hand in hand with the revival of a culture and a tradition while building up a regional economic development, centered around a product with a story that speaks to the imagination: the softest wool on the planet. The production and trade of wild fibers integrated with ecotourism shows that there are ways for local communities to compete

in a global market with limited investments and the uplifting of a region that has been too dependent on government aid for too long. There is an appetite among family office investors to take this initiative to the next level.

Plan A

Clustering culture with tradition and fibers




stimulate a sustainable, local and experience-based tourism
connection between the artisan producer and the end client
gthening image of Patagonia
product traceability
access to textile niche market
unsatisfied demand for diverse and unique textiles
new money circulating in the local economy
no intermediary in the supply chain
be woven [Kg]
fabrics and clothing production [kg/month]
Locally transformed products to be sold [Kg]
high end competitive transformed products sold [kg/month]
ll scale weaving ry
carpets production with the left overs [kg/month]
household income [$/month]
inspiration for further fleece entrepreneurial iniciatives
domestic sales [$/month]
Multiplier effect on the local economy
exports in accordance with CITES [$/month]
decline of the interest in raising sheeps and cows
moval of ative species
protection of the species

Fable 8

A fleece jacket

Cows have turned into the standard of the milk and meat industry. While the European emigrants took their animals to the four corners of the world, searching for a predictable amount of food and nutrition, the newcomers seldom realized that local animals had undergone millennia of adaptation and evolution ending up as ideal partners throughout history. Often, this fauna did not need to be domesticated on the contrary, the strategy of "catch and release" offered all the benefits without the burden of maintenance and feed. This is a time tested model that merits a revisit, especially since it offers an opportunity in a world market of over-supply to offer a few unique products and experiences that are unparalleled in the world.

A vicuña is roaming the highlands of Argentina, close to the border with Bolivia. It is cold and windy when it spots a cow.

"You must have lost your way? Shall I show you how to get back down to the valley?" wonders the vicuña.

"That is very kind of you. I realise you are not only a very elegant habitant of the mountains, you are courteous as well," responds the cow.

"You must be freezing cold, you are not very well dressed for up here."

"I really do not want to be here. I am suffering. The air is so thin that I can hardly breath. Sadly, they will not let me get back to where I belong."

"Who holds you hostage?"

"Well these white people put me on ships and made me travel from far away. That was already stressful, then I was sent up these hills."

"Hills? You are on top of the world. And, if you are not dressed right for this, you will suffer, get sick and eventually die."

"How come you are so well dressed for this hardship?"

"Hardship? This is my home. Look I got a fleece jacket underneath my wool. That keeps me very warm."

"A fleece jacket? What a great invention, I thought Patagonia made it up."

"The people who live here since early times shave off my fleece in the spring to make the finest clothing that protects them through icy winters."

"They shave you? They did not kill you for your hide?"

"Ah no we have lived in harmony for 10,000 years. The people considered us the Goddesses of the Andes. The first woven clothing ever on earth comes from those tiny little fibers than can only be made by us."

"And the softest! Compare your wool to anything. You even make cashmere feel like coarse."

"We do not use wool. We use fleece and the kings of the world desire us. They loved us so much that they left us to roam in the wild, and never forced us into a corral, until the colonizers arrived and wanted cows."

"Why can't I dress up like you? And why can't I run free like you?"

"Because everyone needed millennia to adjust to life at the place that has turns into home. And by the way, your hoofs are too big, and you are too heavy. You damage our fragile soil, and destroy the ice underneath."

"I am sorry. I realized this is certainly not my home. I can hardly grasp for air, and my feet get cold, my nose itches, and I am sneezing all the time."

"Just let us hope that when you leave for home, you are not passing by a slaughterhouse. You may be turned into a sausage before you know."

... *And it only has just begun*!

Argentinian Map of Opportunities

PART C

Transformation of the Energy Economy

The Opportunity
"Seaweed Gas"

$2.5 million/km^2
$8-10/barrel equivalent

Argentina has a sophisticated network for the distribution of natural gas. It has abundant seaweed potentially farmed in its vast territorial waters. 100,000km^2 seem ideal for this purpose.

Tests in South Africa and Indonesia confirm the efficiency in farming and gas production. The by-product is fertilizer ensuring extra cash flow and reduced cost of production.

Plan A

Chapter 8

From Fracking Soil to Farming in 3D

Governments worldwide face big challenges to transform their energy economies. The fossil fuels that have determined energy policies for over a century, are phasing out but they still provide the lion share of the energy needs. As the Norwegian Statoil board stated "There are alternatives but oil is here to stay for decades to come." Wind and solar are fast emerging as the energy sources of the future. However, these renewable sources require a new, and very different, infrastructure. That means large-scale investments for which money is not readily available. So, governments are caught between the urgent need to prepare for change and their inability to write off past investments quickly enough while at the same time they need to ensure that the lights stay on.

In this context, Argentina faces a unique dilemma. For decades, the country supplied neighboring countries with natural gas.

However, in the past ten years, as reserves got exhausted, the gas pipelines started to flow in a reverse direction and the country turned from a net exporter into a net importer of gas from Chile, Bolivia. Today, Argentina even imports expensive gas by maritime transport from the overseas spot market to fuel the country's energy needs. The worst for any politician in office are power cuts.

Plan A

The substitution of cheap local power with imported fuel comes at a heavy price and is draining Argentina each year of billions of dollars. That's why the Argentine government set out on a course to secure the future of energy for the country. Given the existing gas infrastructure, the most logical next step seemed to be the exploration through fracking of the vast shale gas reserves of Argentina, particularly in Patagonia. The government entered into negotiations with big international players like Chevron and Total who stand ready to make large investments in the exploration of shale gas. The price setting— based on demand and the substitution cost of imports—is high securing steady and solid profits for investors.

Anyone who has visited the marvels of Patagonia under- stands the dilemma Argentina is facing. Yes, the country needs cheaper, locally available, energy and with an abundant supply ready to be fracked and cracked why would anyone be that emotional to prohibit the obvious? At the same time, it's hard to imagine that Patagonia's natural beauty would be sacrificed for this goal. The gas industry does not have a clean record when it comes to fracking. According to a recent study in the journal Environmental Science and Technology, dumping fracking water into rivers, lakes, and streams can cause lasting environmental damage, even if the water is treated first.

Shale gas is not even the preferred choice of the industry. It has been estimated that to be competitive shale gas needs a minimum oil price of 50 dollars per barrel. Fracking was an extraordinary business when oil traded above 100 dollars per barrel for years. However, recent developments in the oil market make shale gas much less attractive and hardly a reliable investment for the future despite the interests shown by oil giants. It works when politics are in favor—in spite of environmental and cost concerns—or when local demand largely exceeds supply. Argentina complies with these requisites.

Even in the best scenarios, the future of shale gas is limited due to the economics. It requires a collusion of accounting rules and permit arrangements to become an attractive investment. Forty percent of any newly explored reserves is extracted in the first year of operation; 25 percent

in the second year and 15 percent in the third year. In other words: 80 percent of the reserves are pulled out in the first three years of operation. That makes the investment interesting from a financial perspective: high initial costs are recouped within three years. This return on investment is easy to finance and hard to refuse. This also makes it attractive for a Government keen on providing quick solutions to a complex situation: the reserves are abundant, the technologies are proven, the damage is known, the financing is available and the deployment is as fast as permits can be issued.

There is however a caveat. After the return on investment is made in three years, the remaining 20 percent of the reserves is left untouched. With a 20-year license, the gas companies keep the reserves on their balance sheets for another 17 years. As their stock market valuation is substantially based on their access to proven reserves, these shine in the eyes of investors. This is an important accounting exercise, since it means that the books boost reserves. It also means that the cleanup of the environment will only happen—and paid for—after 20 (or perhaps 17) years. The full costs are not immediately put on the books since the discounted amount would be considered too small, and the exact amount too uncertain. That means the closure costs don't impact the profit margins making the investment even more attractive. In the meantime, societies are left with a lot of uncertainty about the environmental damage and who will remediate it.

And, one day, the remaining reserves will be sold off to another party and the clean-up bill somehow gets lost in the transaction… Alberta, the pioneer province of shale gas and fracking in Canada offers terrifying testimony of these practices.

Argentina finds itself in a complex unfortunate situation. The country has high debts and faces high import costs for energy. It has a multi-billion-dollar gas pipeline infrastructure and has some of the largest shale gas reserves in the world. Despite the high environmental "externalized" costs, development of shale gas seems the only reasonable option. Unless, there's a better alternative…

Plan A

Yes, Argentina should continue to power its economy with gas. However, the country has the great opportunity to harvest that gas from seaweed plantations along its long coast line in a completely clean and renewable way with many externalized *benefits*. You read that well: instead of external costs, this energy model generates external benefits. This is the key element of the new rules of the economy in transformation.

Argentina has 3.3 million square kilometers of territorial seas. A team of 14 local scientists headed by Prof. Dr. Elisa Parodi from the National University of the South in Bahia Blanca estimates that one third of this area—about 1 million square kilometers—is good for farming seaweeds, and one could agree that 10% is ideal, still good for a whopping 100,000 km^2. The ocean along the country's coast is not very deep and the water temperature is optimal for seaweed cultivation. In fact, Argentina was the world's largest exporter of seaweeds until the early 1970s. The seaweed was harvested and sold around the world as fertilizer and animal feed additives. The Argentine seaweed sector died when natural gas replaced seaweed as the resource for synthetic fertilizers. And the country lost its interest in a labor-intensive process and discovered the ease of export of protein from meat and soy based on an abundance of land.

Today, seaweed offers a new opportunity and the basis for a major transformation of the energy economy. Recent tests conducted by seaweed farming expert INRADA from the Netherlands off the coast of Cape Town in South Africa demonstrate that one hectare of seaweeds can produce—in two production cycles of six months—as much as 1,000 tons per year. That biomass of 1,000 tons can be converted in 200,000 cubic meters of gas per year or 548 cubic meters of gas per day for 365 days a year, forever! Similar results were produced in experiments in Indonesia and South Africa. A successful shale gas field in the United States is happy with an output of 6,000 cubic meters per hour or some 50 million cubic meters per year. And that field produces gas for three years… 250 hectares, or 2.5 square kilometers, of seaweed replaces the production that shale gas field—every year, forever (that is as long as the sun shines and there's water in the ocean).

If Argentina farms seaweeds on 100,000 square kilometers—one thirthieth of its territorial seas—it can generate 4 billion tons of seaweeds annually or an "eternal supply" of 800 billion cubic meters of gas. And that seaweed plantation of 100,000 square kilometers sequesters 450 million ton CO_2 each year.

The potential of seaweed gas is massive. The United States could fulfill its entire annual energy needs with seaweed farms totalling 650,000 square kilometers—that's less than the Argentinean capacity of 1 million square kilometers. By comparison: today farmers cultivate 3.7 million square kilometers of land in the U.S.

The productivity of seaweeds can be explained by the fact that farming in the sea happens in a three-dimensional environment. The seaweeds grow easily three meters deep unaffected by gravity, and can reach depths of 25 meters. That allows for a volume and a speed of conversion of solar energy that are impossible to achieve in farming in a two-dimensional environment on land. In addition, water is 784 times denser than air and supplies a multiple of nutrients per cubic meter. The productivity levels of three-dimensional farming in the sea lies beyond the reach of the most advanced genetics and chemical cocktails. This is not a matter of for and against, this is matter of the laws of physics that determine dimension and density.

The harvested seaweed is washed and processed so that all the cells are ruptured, and enriched with hydrogen. Now, it can be fermented and new technology makes it possible to efficiently generate methane at scale. Producing biogas through the fermentation of seaweed in a digester is a simple process compared to, for instance, converting corn into ethanol which is a capital-intensive chemical process. The pre-processing of seaweed before the digestion, and the use of 12 chambers for the processing increases the conversion of the biomass into methane (CH_4) to 90 percent and cuts the retention time to 8-9 days. This increases the efficiency of biomass from the sea compared with any other source with a factor 50. That's disruptive.

There's another factor that makes seaweed as a source for biogas very compelling: the infrastructure. Argentina, like most countries, has an existing infrastructure of natural gas pipelines. That means that a

transition to biogas from seaweeds doesn't require massive infrastructural investments. An equally potent gas is going to flow through the same pipes. That makes seaweed very attractive as a source for power even compared to the rapid rise of wind and solar. This appeals to the Captains of Legacy who through their family offices monitor these developments with Argus eyes. The only thing that is required is the adaptation of the gas to the specifications required for pipeline transmissions. That is not a problem. Shale from fracking requires a similar adaptation.

Seaweed does need some infrastructure, though. The weeds can be cultivated on platforms that use the same buoyancy science to the one developed by the oil industry for offshore oil exploration that will be placed along the coast in a modular way at an investment of 25,000 dollars per hectare (2.5 million dollars per square kilometer). A greater challenge will be the digester infrastructure, but its cost is already included in the 25,000 ballpark number. The digestion process as described above is simple. However, that process needs to be scaled to a level that it can feed Argentina's vast infrastructure of gas pipelines. That's a different order of magnitude from digesting biomass into biogas at a piggery farm. This project requires a management team that is capable of going to scale with speed.

We need to imagine digester parks in zones that are close to the harvesting points in order to reduce transportation costs. Still, investing in seaweed biogas over a 10-year period is much more efficient than investing in shale gas as the graph above shows. Shale gas can only be competitive at around 50 dollars per barrel. Seaweed gas can be produced for to 8 to 10 dollars a barrel.

But there are two major other reasons why the seaweed energy potential outcompetes shale gas through fracking. Shale gas is a limited resource. The supply will end sooner or later. On the other hand, seaweed gas can be harvested forever. Investments made today—and maintained over time—will produce eternal returns. Seaweed gas is a truly clean and renewable resource. There are no "closure costs". The are operational expenses that will decrease as experience is gained.

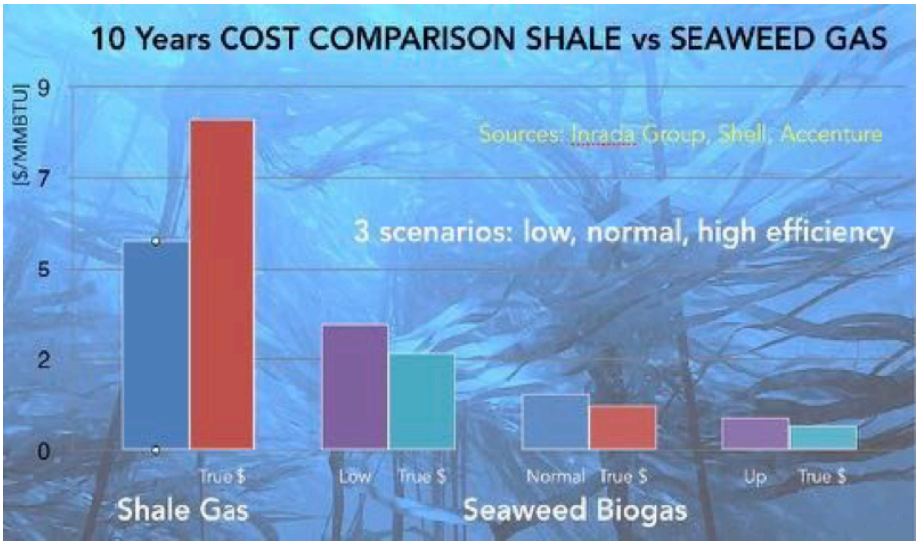
Secondly, we are used to economic activity and business having unwanted side-effects. We call these unintended consequences externalized costs. Despite the fact that (most) companies carry "closure costs" for their harmful activities on their balance sheets (by law), these are usually costs that society has to bear in terms of environmental degradation or compromised public health.

The exploration of shale gas is clear example of an activity that comes with high external costs. By expert verification the cost of production of shale gas would be 5.2 dollars per million BTU whereas the total cost including all risks and damages plus compensation and restoration would push it above 8 dollars. By comparison the exploration of seaweed gas comes with externalized benefits: (un)intended, beneficial side-effects. That means that the cost drops per unit of energy, since there are additional incomes and the power to regenerate the dynamics of an ecosystem.

After digestion of the seaweed biomass into gas, two percent of the original weight (wet based) remains. That byproduct of the digestion is an ideal fertilizer. Remember: Argentina is currently also importing natural gas to produce fertilizer! The seaweed biomass also provides a great source for animal feed: seaweed can replace the soy plantations that have depleted vast areas of agricultural soils for our growing meat consumption.

Moreover, part of the seaweed production can be used for additional lucrative business activities. Nearly all processed and frozen foods around the world include seaweed extracts to maintain softness and texture. Seaweed extracts as agar-agar and carrageenan are key ingredients of for products like toothpaste, ice cream, and cosmetic creams and lotions. Like for yeast and vicuña, there is no synthetic alternative for seaweeds.

Seaweed farming can also provide fibers for the textile industry. In the 1940s British scientists already discovered that fibers from seaweeds could be used as non-toxic, non-irritating, biodegradable woven material to treat wounds. Seaweed-based gauze has an anti-inflammatory capacity as well while it maintains a certain degree of humidity which supports wound healing.



Since the early 2000s, advanced technologies have introduced seaweed fiber in the production of apparel—mostly in knits, underwear, and sportswear. As the technology improves seaweed clothing and towels are rapidly arriving as an alternative for cotton that drains water resources, and pollutes them with toxins. Note: Cultivating seaweed doesn't require water. In fact, farming seaweed produces fresh water as byproduct that can be used in the industrial processes that unfold as new industrial clusters emerge. The companies like Lensing in Austria pioneered this technology in Europe but the first experiences are from Qingdao in China where already millions of units of towels are made with fibers derived from seaweed.

But possibly the most game-changing element of seaweed cultivation is its contribution to the environment. Fracking and fossil fuel exploitation *degrade* the environment. These activities are damaging nature and the name of the game is to mitigate the impact. Seaweed cultivation, however, *regenerates* nature. It is very alkaline and maintains the critical pH level in the oceans at 8.2 helping to avert the dangerous drop to 8.1 and below leading to the destruction of coral reefs and the incapacity of shells to form. Moreover, since dragnet fishing has erased life on the bottom of the

sea, there's an urgent need to regenerate the biodiversity of the sea. Once there is an abundance of seaweeds—the precursors of life in the ocean—, sponges and seashells nestle in, fish arrive in a zone where they feel protected from predators. The right conditions to farm oysters, abalones, mussels or crustaceans emerge as well according to the local biota that has to be kept free of invasive and non-native species.

As the marine environment regenerates, fish stocks—severely depleted from overfishing—get restored. And the beauty of the three-dimensional ecosystem of the sea is that it doesn't need any input—irrigation, fertilizers or pesticides. The living organisms feed themselves.

Research shows how critical seafood is for our health. Omega-3 fatty acids from algae—that we can eat directly or through fish, especially through anchovies and herring, who feed on sea plants too—have been linked in many studies to better brain and heart health. So, we need healthy seas and seaweed cultivation is the first step towards restoring the ecosystem of the oceans.

In other words: Seaweed generates multiple sustainable industries with parallel revenue streams that all operate within the ecosystem. Seaweed cultivation will redesign major sectors of the economy that are trapped in the conventional fossil fuel energy logic. On top of that, seaweed sequesters carbon dioxide. Some varieties absorb five times more CO_2 than land-based plants. If electricity is generated from seaweed, it will only emit 11 grams of carbon per kilowatt-hour taking into account the building of the infrastructure, whereas the average other energy source for electricity emits more than 500 grams per kWh.

Given the wide-ranging and compelling advantages of seaweed cultivation, it doesn't come as a surprise that innovative seaweed initiatives are undertaken around the globe. Indonesia is building a 100 MW energy plant that will be completely powered by seaweed. Belgium is contemplating seaweed farming as part of a new initiative to protect its coastal zone against climate change. Recently, the U.S. government, after first concluding that a multi-million dollar subsidy program for the production of ethanol from corn had reached its end, awarded a series of

contracts to stimulate the cultivation of seaweeds for the production of biogas.

Argentina has a great opportunity to join this seaweed driven wave to transform of the energy economy that has dominated societies for over a century. With modest investments of 25,000 dollars per platform, Argentina can substitute imports of natural gas between 18 and 24 months with domestic biogas production. Within 5 years, it's possible to replace gas imports from neighboring countries. This will save Argentina annually billions of dollars.

There are challenges to overcome. The two zones selected for the first 100 square kilometers of seaweed farms don't have enough people living on the coasts to provide the necessary labor as the local seaweed cultivation was abandoned some 40 years.

The digester technology needs to be scaled and the know-how must be transferred. Argentina needs to change the law that prohibits the distribution of biogas, that typically includes corrosive elements, through the existing natural gas pipelines. However, seaweed-derived gas has extremely low hydrogen sulfide (H_2S), much less than shale gas contains, that is now permitted to be distributed through the existing infrastructure. The corrosion gases have been addressed in the digester technology but the old law is still in place singling out biogass.

Finally, shale gas investments—about 15 million dollars per well—are typically financed by one major gas multinational; seaweed cultivation requires much smaller investments that have to come from multiple smaller companies. But with a guaranteed demand at a competitive price that will be a lucrative opportunity. In fact, the first established seaweed farm can produce sufficient income to finance 10 (!) new ones that can generate biomass as long as the sun shines and there's water in the ocean.

Seaweed farming is a global game-changer. Argentina is ideally positioned to present itself as a pioneer and leader in this field showing that there's a better energy future than devastating natural beauty through fracking to produce shale gas. The list of advantages and benefits is long and compelling: Seaweed cultivation is more efficient than shale

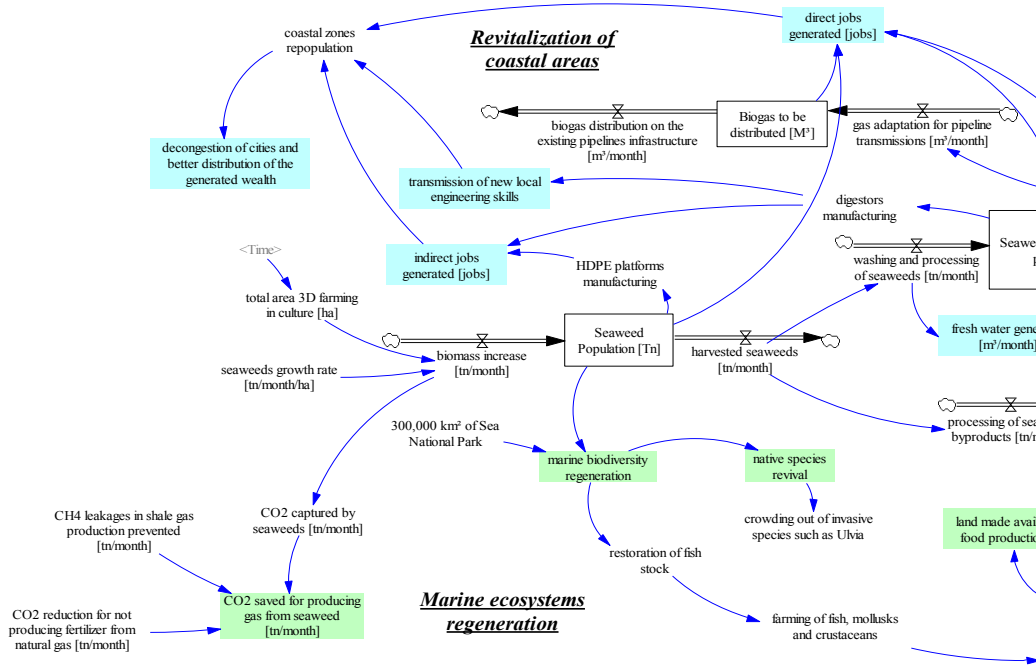
gas exploration; it provides an endless energy source whereas shale gas resources will get exhausted. Seaweed can not only substitute natural gas imports, it also delivers organic fertilizer. It can be distributed using the existing natural gas infrastructure (the same applies to shale gas).

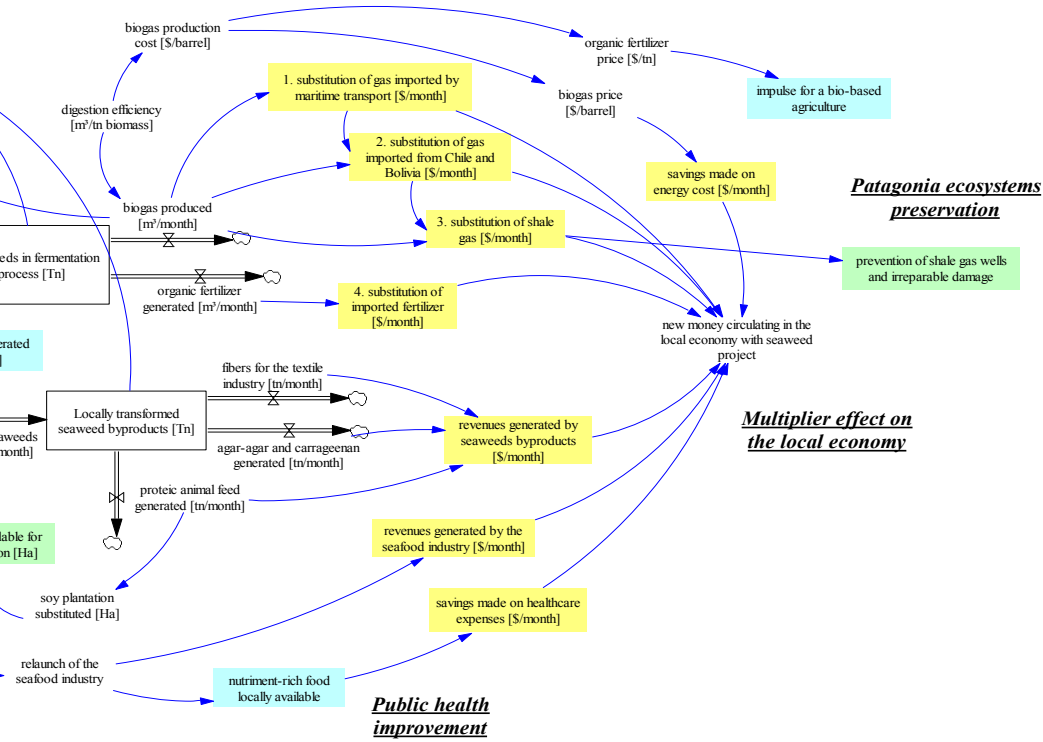
Seaweed cultivation protects the natural beauty of Patagonia while it regenerates the marine ecosystem along Argentina's coast which will support the restoration of fish stocks. Once seaweed forests start to recover the coastal zones, they will temper the waves, and protect coastal zones against rising sea levels while they sequester carbon and helps to mitigate climate change as a zero-emissions energy source. Finally, seaweed cultivation offers multiple additional benefits from animal feed, to ingredients for the textile, food and cosmetics industries.

We are standing at the beginning of an energy revolution. Seaweed cultivation doesn't compare with anything that we have had and this is why a new generation of investors is required, pioneers who we have labeled as Captains of Legacy. It will inspire generations of scientists and entrepreneurs to come with opportunities to fuel and feed societies in sustainable and renewable ways. This is an extraordinary opportunity for Argentina and for those leaders and investors in the country who want to transform the economy and put the nation on a true path of sustainable development, responding to the basic needs of all, with what is available within the existing carrying capacity, while offering a solid and continuous return with a low risk, provided the entrepreneurs operate with speed and reach scale to impact the country and to change the statistics once and for all.

Plan A

Clustering seaweed with gas and fertilizers




biogas production cost [$/barrel]
organic fertilizer price [$/tn]
digestion efficiency [m³/tn biomass]
1. substitution of gas imported by maritime transport [$/month]
biogas price [$/barrel]
impulse for a bio-based agriculture
2. substitution of gas imported from Chile and Bolivia [$/month]
savings made on energy cost [$/month]
Patagonia ecosystems preservation
biogas produced [m³/month]
3. substitution of shale gas [$/month]
prevention of shale gas wells and irreparable damage
organic fertilizer generated [m³/month]
4. substitution of imported fertilizer [$/month]
new money circulating in the local economy with seaweed project
fibers for the textile industry [tn/month]
Locally transformed seaweed byproducts [Tn]
revenues generated by seaweeds byproducts [$/month]
Multiplier effect on the local economy
agar-agar and carrageenan generated [tn/month]
proteic animal feed generated [tn/month]
revenues generated by the seafood industry [$/month]
soy plantation substituted [Ha]
savings made on healthcare expenses [$/month]
relaunch of the seafood industry
nutriment-rich food locally available
Public health improvement

Fable 9

Adding a dimension

The next industrial revolution is inspired by robotics and 3D printing. The energy sector is going through a transformation from extraction to 3D energy farming. While the term is new, the underlaying technologies are well established and ready for implementation with speed and scale. Since the technology mix is new, and few have experience with it. Still the trials around the world are convincing. This strategy is not one for energy only, it combines the breakthrough for eradicating hunger with the creation of an abundance of energy – at low cost and without generating any emissions.

A fly was listening in on a conversation of people, and shares what it overheard with a silverfish. It is all about a new machine.

"Everyone in the office is so excited about this 3D printer, no one even bothered chasing after me," says the fly.

"I do not get excited about this machine. It spews strange gases and seems to use a lot of plastics."

"Nothing is perfect from day one. You need to display some patience and learn from this novelty. Eventually, everything can turn for the better."

"I admire your positive approach, but I am worried that this printer will just be a toy, create a lot of hype and discussions, cut jobs, and divert all attention away from the real challenges the world faces."

"I did not know that you were interested in the troubles we all face? What stresses you out the most?"

"It is time that we find a solution for food. There is simply not enough food, and what we eat is mostly rubbish. Where are the good old days when everything was organic and natural."

"That is back then when there were only one billion people on Earth. Do you realize what it means to feed soon 10 billion mouths?"

"We have heard that before, and as more and more people populate a limited space we keep on farming in 2D."

"What do you mean, farming in two dimensions?"

"If we are not embracing three dimensions and tackle more problems all at once, we will never ever shift from scarcity to abundance."

"You are out of your mind. With 10 billion people to feed we can never eradicate hunger and poverty, let alone dream about abundance for all."

"May I beg to differ? Instead of all that buzz about 3D printers, why is there no buzz about 3D farming?"

"Never heard of that! Sounds like magic to me!"

"Magic? When a rainforest produces biomass, is that in 2 or 3 dimensions?"

"Deep forests have high trees and different bushes of all sizes. So it is 3D!"

"And kelp growing in the sea with the sponges and shells is that 2 or 3D?"

"Obvious - that is 3D."

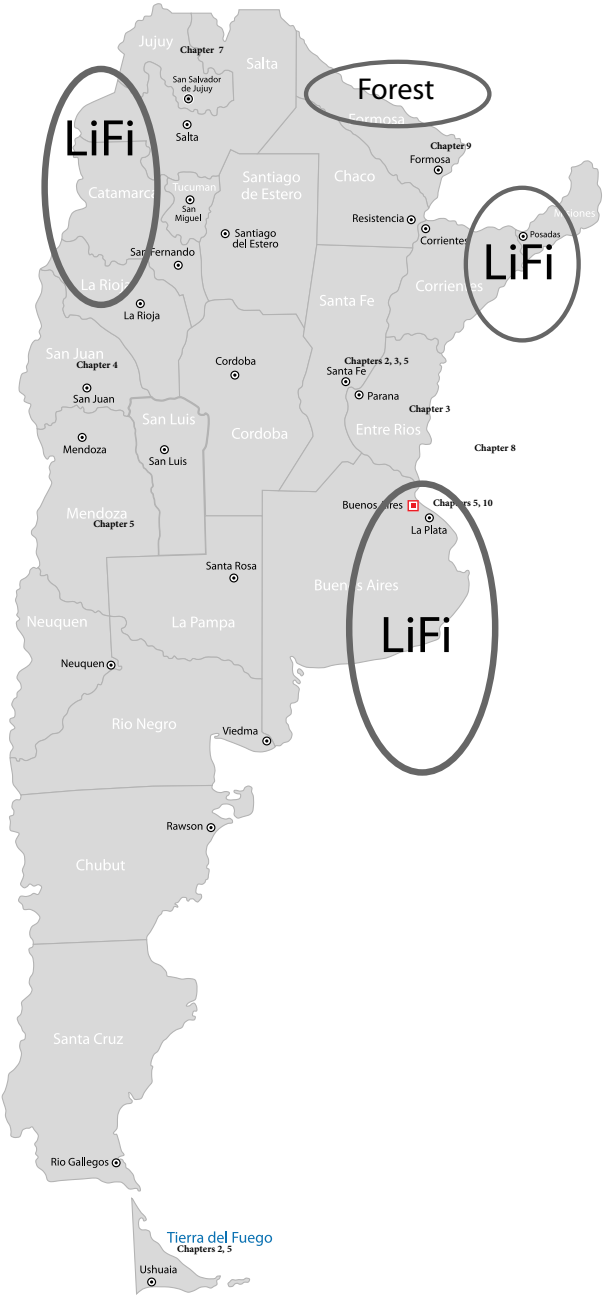
"So why are we worried about how much crops produce per acre. Time has come to see how many tons we can produce in all the space that we have."

"You are so right! Farming in the sea offers tens times more space than on land and no one has to work against gravity."

"Time has come to do better forever, regenerate the space, use the nutrients we have, and nothing else, and hunger will be history forever."

... *And it only has just begun*!

Argentinian Map of Opportunities



PART D

Reaching the Unreached

The Opportunity
"Reforestation"

biodiversity x 20
land value x 10

Argentina has the opportunity to reverse its long trend and tradition of deforestion. The regeneration of forests in Formosa based on the scientific input of a pollen study, regenerates community, food, water, fuel and jobs.

Las Gaviotas in Colombia has proven the concept. The region enjoys full employment, infant mortality dropped to the lowest in the nation and the products are competitive even against Chinese imports.

Plan A

Chapter 9

Reaching full employment converting savanna to forest

Every second, some 500 trees, which on average take 20 years to become fully grown, are cut on the planet. That is 15 billion trees every year. Most of these trees are cut to make space to grow more food. It is sad and painful that the planet is still losing valuable forest cover, which protects the soil from drying out; it is even sadder and more painful that deforestation ultimately hampers the very agriculture and food supply for which the trees make way. Over 50 percent of the planet's tree cover has been lost in an unrelenting process that is like pulling off the skin of the earth. It not only hurts, but after a while there is no way you can continue to warrant the same living conditions without trees. Europe is the only continent where the number of trees growing is constantly increasing.

According to the Food and Agriculture Organization of the United Nations (FAO), Argentina is among the top ten countries that destroy their forests the most. The FAO calculates the loss has amounted to 8 million hectares since 1990. In almost three decades Argentina's forest cover decreased from 13 percent of the country's landmass to 10 percent.

The deforestation is mostly—80 percent—taking place in the northeastern part of the country. That is where Douglas and Kris Tompkins in collaboration with Georges Soros and Harvard University, started a conservation project with the aim of preserving and strengthening the 553,000 hectares Iberá Provincial Natural Reserve in the Province of

Corrientes, which was founded in 1983. The project acquired 150,000 hectares of old cattle ranches bordering the existing natural reserve. The goal is to help these lands transition from "an exploitative economy" to "an economy of conservation and ecotourism" before they will be returned to the Argentine government to be included in the reserve. This will create the largest national park in Argentina with 700,000 hectares.

The Tompkins' initiative helps but, at the same time, satellite data continue to confirm a clear link between areas planted with soybeans and the deforestation of native Argentinean forests. Taking away the trees, creates vast, accessible fields that can easily be plowed. That starts monoculture farming intended to produce the highest possible yields using chemistry—fertilizers, herbicides, fungicides, and pesticides—and genetics (GMOs). The problem is that we have been ignoring the laws of physics that determine the delicate balance between water and sun. But, as it turns out, we ultimately cannot defy physics with chemistry and genetics. This Plan A builds on several strategic opportunities that are embedded in the transformation of the supply of protein and energy which could reach a whole new order of magnitude—far beyond the promise of fast growing trees—when we shift the business model to follow the laws of physics. This is a critical framework in order to understand the emerging investment opportunity that will be discussed for the Province of Formosa.

But there's another reason why we have to make that shift. When we expose the soil directly to the blazing sun, ultraviolet rays will sanitize everything. The sun kills the nutrients the plants need. So, we need more chemicals to replenish what we lost, and we cannot regenerate the ecosystem without re-creating the shade. Exposure to the sun also makes sure that the temperature of the soil will rise. The soil becomes warmer than the rain. That means that when the rain hits the soil, the water evaporates immediately. Morning dew is gone before it can benefit the plants. The water doesn't get a chance to penetrate the soil and feed the crops.

There's no canopy of trees above the field that can catch the water and cascade it gradually back into the underground, streams and rivers. This

leads to a free fall of the rain drops: torrential rains cause havoc on the exposed soil, increasing erosion and reducing the water absorption capacity. We dry out the land in search of higher levels of productivity, and then we need irrigation, including the energy required to pump the water and the pipes that channel the water, to the point of consumption. That process of irrigation creates over-mineralization of the soil. It puts the wrong mix of minerals into the ground and gradually makes the soil infertile; it creates a kind of "stone" layer that ensures that heavy rains—when the water won't evaporate right away—provoke flooding. Argentine suffers massively from these phenomena. It is too easy to blame climate change. Rather it is a complex interchange between massive deforestation and soil degradation that stands at the core of these floods. The flooding washes away the debris of decomposing biomass that should have provided the nutrients for the next harvest, and we now enter a trap where we need to keep adding more and more fertilizers. In order to reduce the costs of the destruction of the cycles of water and temperature, there are increasing calls for new genetics—plants that resist these uncertainties that were created by our own drive to maximize output.

This is exactly what we have seen happening throughout Argentina. The productivity of farming goes down, yields drop, and costs increase reducing margins. The use of chemicals constraints the export opportunity, especially since the European Union has imposed stringent limits on the residual traces of agro-chemicals. That means export has shifted to China, which pays lower prices and squeezes the margins of the farmers who search for solution in economies of scale.

In other words: The simple misunderstanding of how physics works leads to deforestation and ultimately to desertification. Or even shorter: Cutting trees to make space for agriculture leads over a period of two to three decades to less food and to more hunger. We need trees because they stand at the core of the ecosystem and the natural cover that emerged over millennia contributes to a composition of the atmosphere on which human life depends. Trees are the skin of the earth, and it is about time we take their presence seriously—at least if we want to feed the world. There's

no better proof for the vital presence of trees and their predominant role in transforming business and society than the story of Las Gaviotas in Colombia. This is the model we propose to emulate in Argentina.

In 1967 Paolo Lugari founded a village in the Vichada region of the Orinoco River in the eastern savannas of Colombia. It was an area where no one thought anything could grow, as the Spanish conquistadores had cut down the last trees 250 years prior. Fifteen million acres of land lost tree coverage long before deforestation in the Amazon rainforest gained international attention. The soil and the water had turned acidic, and 70 percent of the remaining population of a mere 26,000 people suffered from gastrointestinal illnesses. The land is exposed to the scorching sun for nine months of the year, while torrential rains during the remaining three months make life very difficult. Chemistry and genetics had no response to the degeneration of the land, and the region suffered the highest infant death and unemployment rates of Colombia.

Lugari, a self-taught creative who thinks and operates far outside the influence of traditional education, realized that the first requirement to regenerate the ecosystem was an inversion of the temperature difference between the soil and the rain. As long as the soil kept being exposed to the sun, the rain could never penetrate the thin layer of earth, and all organic matter would be washed away, further eroding the soil. If, on the other hand, he could find a tree that could survive the heat and create shade, then new life could emerge. After carefully studying the local environment and the ecosystems in this tropical belt of Latin America, Lugari chose to plant a Caribbean pine tree he had found in Nicaraguan forests. He planted the first seeds in Las Gaviotas, but despite all his attention and care, none survived four months of heat and drought. He went back to Nicaragua, and when he studied the trees more closely, he discovered that the most flourishing pine trees had mushrooms growing at their roots. Lugari decided to mix his seeds with a "mushroom soup." That worked. The planting of the trees started in 1987. And today, after 30 years and planting some eight million trees on 8,000 hectares (20,000 acres), Las Gaviotas sits amidst a reborn rainforest that is surrounded

by barren savannas. This replanting program resulted in one of the most profitable investments ever in forest regeneration, while the benefits for the community are beyond expectations.

At the start of the project 47 species inhabited the lands, including 11 non-native grasses. Now researchers count more than 250 reborn native plant species per hectare, more than in many parts of the Amazon, and that number continues to rise. All non-native species are gone. The regeneration of the ecosystem strengthened the endemic species and crowded out the invasive ones. Nature has rediscovered its true evolutionary path. The small pockets of biodiversity left along the rivers provided the biotas that got transported by the wind, birds, and bees. In addition, as the pine trees grew and began to protect the soil from the tropical sun, dormant seeds that had been buried for centuries came back to life, recreating an ecosystem with many other trees, flowers, shrubs, and animals. The villagers have rediscovered all kinds of perfectly edible "new" fruits and edible plants in the forest that grow perfectly well without any effort. They discovered a kind of potato bush which bears a fruit that tastes like chocolate. They found a spinach plant that doesn't look like the spinach we know, but has the same taste and nutrition; and a coffee plant that doesn't look like coffee but boosts an unmistakingly coffee smell. Of course, one could ask why the locals do not plant "real" potatoes, from other places in South America; "real" spinach, originally from Persia; or "real" coffee beans from Africa. The response is simple: These are gifts from the forests and are perfectly adapted to the climatological conditions of the region and grow effortless without the need for any chemistry or genetics. The families at Las Gaviotas are not new-born hunter-gatherers; rather they are observing how laws of physics drive nature, and they are reaping the fruits from it. This is an investment opportunity where the risk is low, and the performance is secured.

The Las Gaviotas experience shows that trees are not just allies when it comes to reversing global warming because they take carbon dioxide out of the air. Trees start the inversion of the temperature that is necessary to create the conditions for the soil to be restored and replenished with

carbon, and with that—spontaneously—dozens and dozens of species can come back to life, creating an ongoing positive feedback loop and a self-regenerating healthy ecosystem. One of the main transformations of the forest is that the canopies and the roots of all these new trees and plants—especially the undergrowth that traps the moisture—also replenish the water table. The forest cover has allowed the laws of physics to bring back the temperature differentials that generate more rain, as has been documented with four decades of meteorological data captured on site. A region that was once known for its bad water is now, according to Japanese water expert Masaru Emoto, the source of water classified as the simplest and the most ecological with a healthy mineral balance. Emoto photographed a beautiful water crystal that symbolized the fundamentals. The shape of the crystal—a perfect hexagonal geometry—demonstrates to the experts who believe that water quality can be measured by the geometry of its frozen state that this water is pure. Las Gaviotas distributes this healthy water for free to the local population, and as a result the gastrointestinal illnesses have disappeared. To finance the distribution of subsidized free water to the local population, Las Gaviotas sells 10 percent of it to the restaurant chain Wok in Bogota.

Las Gaviotas is using the laws of physics in another productive way as well. The trees that first provided the cover for the rainforest to come back now offer another valuable asset. The villagers tap resin from the pine trees, which is used to produce chemicals and biodiesel. Most biodiesel in the world is created through a chemical reaction of a plant oil and methanol. The methanol splits the plant oil into glycerin and a diesel, changing the esters so that the oil will easily burn to power a combustion engine. In other words: Nature is chemically changed in order to suit the demands of an engine. However, methanol is expensive, and the necessary chemical reaction must be controlled. It also needs to be carefully monitored, therefore requiring a substantial capital investment.

Las Gaviotas, however, doesn't use chemistry to produce biodiesel, but physics, avoiding risky reactions and so cutting the high capital investments to less than 10 percent of the market standard. It also has proven that

small local supply units responding to local demand are competitive. They ensure that money keeps circulating in the local economy in stark contrast with the model of imported fuels based on large facilities that search for ever higher economies of scale.

In a small on-site facility, the resin collected from the pine trees, through steam distillation, is separated into solid colophon—an ingredient for the paint industry—and turpentine—a highly flammable chemical traditionally used to cleanse paint brushes. The purification is done by decanting, filtration, micro-filtration, temperature, pressure, which leads to physical separation through specific weight and density in a matter of hours. The colophon dries and cools off in cardboard and is sold as an additive to the paint and paper industry. The turpentine is an extraordinary fuel that already is a—naturally produced—transester! That means that there is no need for methanol, and a chemical reaction, to create a higher quality biofuel at much lower cost. The fuel will power any gasoline or diesel engine. That is not new. Mr. Soichiro Honda, who created the Honda automobile company after World War II, delivered motorcycles that ran on turpentine. And thanks to the 70 percent pine forest cover of Japan, there were grand reserves of this fuel. Las Gaviotas is self-sufficient in energy with a fuel that can simply and cheaply be produced using the laws of nature. The village even goes to the next level of fuel production with the blending of two non-toxic substances. The biofuel is converted into a biodiesel, mixing the turpentine with pine oil from the same trees, and used vegetable cooking oils from restaurants in Bogota, which are brought back by the trucks delivering Las Gaviotas water to the capital. This blend is ideal for diesel engines.

One could argue that Las Gaviotas is lucky to have the tropical pine trees that produce the turpentine; other places where fuels like diesel and ethanol are made from corn or sugar cane are not as lucky, because they don't have pine trees. Or, one could say: This is exactly why we need to shift the traditional business model for land use with an economic model based on an integrated strategy for fuel, food, and jobs. It's inefficient to cultivate monoculture fields of corn and sugar cane, which extract nutrients from the soil, depleting the

carbon that has accumulated over decades and sometimes centuries.

The case of Las Gaviotas shows that the regeneration of the forests of the world—the restoration of the planet's natural skin—is more than the planting of trees to capture carbon emissions, thus protecting the ecosystem. It is about the design of a business model where the efficiency and the competitiveness is determined by the ease of producing multiple outputs and benefits, which combined are offered at a low cost since so much more value is generated. It may be surprising for many to note that it is easy to avoid the petrochemical cracking and fracking of petroleum and the chemical conversion of vegetables oils with simple, cheap local production.

We should plant pine trees around the crops where the climate and the soil suits that approach so that turpentine can be harvested and blended with the oils from fruits, flowers, and seeds of plants into biodiesel; and in so doing farmers are easily able to add an additional cash flow into their operations. Imagine what it implies for the local territorial development when there is no more need to import any fuel. It is one of the greatest catalysts in the local economy.

When Lyonpo Dr. Pema Gyamtsho, the Minister of Agriculture and Forestry of Bhutan (a country that is 70 percent covered with pine forests), visited Las Gaviotas and realized the breakthrough that was achieved there, he concluded quickly that the future of his Himalayan Kingdom does not lie in the importation of more oil from the Middle East, but rather in the harvesting of the fuel that the country already possesses.

Argentina has her own opportunity to replicate the Las Gaviotas story. This is an investment proposal that offers extraordinary returns. In the region of the Province of Formosa in the Northeast of the country close to the border with Paraguay, a large territory of 60,000 hectares has been offered by private investors. The climatological, geographical and soil conditions of this region resembles the barren savannas around Las Gaviotas as was confirmed by a visit of Prof. Carlos Bernal, Director of ZERI Latin America. Prof. Bernal, who has a 20 years of experience of working with Las Gaviotas, has advised that after a first analysis that in

Formosa, similarly, through the planting of pine trees a rainforest can be recreated.

The ownership and the local cultural environment carry great similarities too. The region is like Las Gaviotas at the outset of the initiative, sparsely populated with only 69 families in three small villages each benefiting from a small school and a health post. Water and communications are scarce and the population survives from hunting, gathering and small-scale agriculture. The Bellsolá Ferrer family has owned the 60,000 hectares of the *Asociacion de Parques* for years. The neighbors include the Wichi Native Community which owns a 5,000 hectares reserve.

The Bellsolá family has attempted to regenerate the forest cover. They made an inventory of all plant biodiversity and offered to manage the regeneration of the forest in cooperation with the national authorities and researched the local conditions in cooperation with the National University in Formosa. However, the challenge is that the local tree species—including Palo Santo, *algarrobos* (carob), and Mora (mulberries)—are very valuable and are harvested beyond their carrying capacity. This fuels ongoing deforestation.

The Bellsolá family has collected seeds, created small tree nurseries, organized internal distribution of seeds. An area of 1,500 hectares was planted to demonstrate that it is possible to overcome the climatological conditions which include a harsh hot and dry spell of up to 9 months, and 3 months of torrential rains—again similar to Las Gaviotas. The only difference is that this region can experience a few weeks of frost each year. That determines the tree varieties to be chosen to kick-start the reforestation initiative. The Ministry of Environment and Sustainable Development of Argentina is committed to establish the tree nurseries in the country to speed up reforestation programs. That complementary effort facilitates the necessary investments.

An initial pollen study will offer an overview of all the plants that have been flourishing in this ecosystem over the centuries. The outcome of that study will provide the basis of a strategic development plan including the economic opportunities related to the chosen species. It will be clear

from the start— like in Las Gaviotas—which species will return once the soil is covered and protected. It is already known that highly prized tree species like carob and Palo Santo grow in the wild in this region providing multiple cash flows supporting the investment logic.

The program needs to include a policy that permits people to return to their land. The 69 families living at present in the region are not in any position to undertake any large-scale regeneration of the native forest. That's why the first focus should be—and the owners are in agreement with this—to ensure that the local community, as well as the local school, has their own basic water and food guaranteed. This will create confidence. Subsequently, the local population senses the opportunity to full employment in the reforestation initiative before new comers may arrive to participate in this project to transform a regional environment and economy.

While the carob and the Palo Santo are obvious starts, the pollen study identifies which trees and shrubs were part of this ecosystem over the past centuries. Tropical pines that resist spells of cold weather could within three to four years the first turpentine from pine trees or the production of biodiesel can be harvested. The local community—that currently has no access to power other than through generators that run on fossil fuels—will provide the first customers. And, again inspired by Las Gaviotas, gradually a second revenue stream emerges as the growing forest begins to produce drinking water. Today, most drinking water in Formosa comes out of plastic bottles, imported, draining the region of financial resources, loading it with plastic waste. The key to relaunching a local economy characterized by poverty and unemployment is to ensure that the very basic services are provided locally starting with water, food, and health. From these initial steps a portfolio of competitive industries that provide food and energy, while replenishing top soil, sequestering CO_2, providing drinking water, and regenerating biodiversity. That is the scientifically proven and economically viable strategy of Las Gaviotas.

Like in the inspiring example of Las Gaviotas, physics and chemistry can work together to create a sustainable and very competitive outcome in

Formosa. The critical message of this initiative is that the understanding and application of physics comes first. If we continue to rely only on chemistry and genetics to produce food and fuel without considering the opportunities offered by physics, the destruction of the planet will continue while we spend too much money and energy on temporary solutions that will not transform society. The production completely changes when trees are planted and the laws of physics are brought back into the equation. Then nature's genius will lead to environmental restoration and regeneration, and a productivity that will let communities flourish.

The power of nature makes this a superb investment for ongoing value. In Las Gaviotas, the core investment of 1,100 dollars per hectare of tree planting set in motion a regeneration of biodiversity with today is as diverse as the Amazon rainforest. The estimated investment for Formosa is similar. Then there is an additional key element in the valuation and the risk analysis of such an investment.

Land that has no water and no electricity provides no chance for a livelihood, and has hardly any value. The value of land that provides water, power and even generates full employment building social capital in an environment of peace and tranquility, increases with a multitude. A range of commercial products and activities emerges: the resin of the trees, the production of drinking water, the harvesting of food, the generation of turpentine and vegetable oil which can be blended into a biodiesel of the simplest type and the lowest cost.

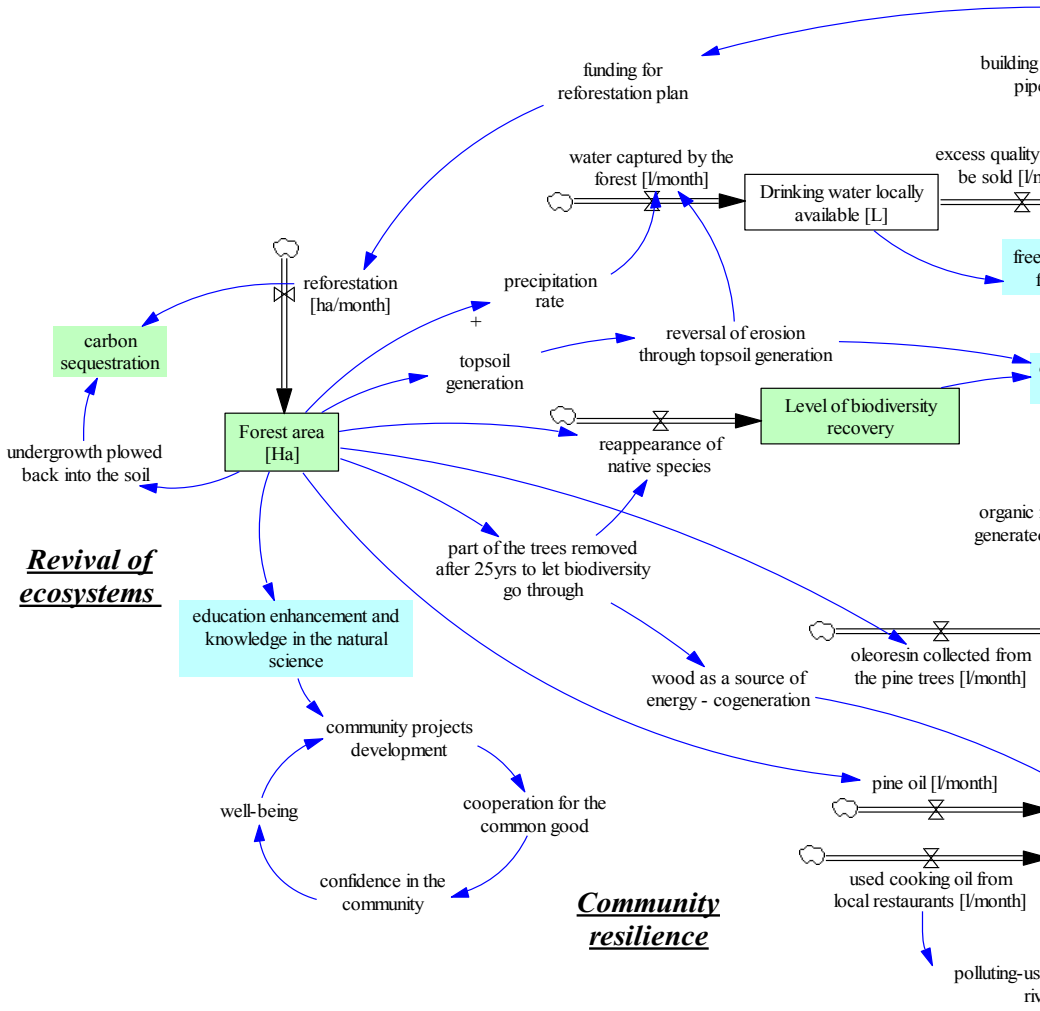
When JP Morgan studied the Las Gaviotas case, a team of experts concluded that the value of the land had increased 3,000 times since the acquisition. And that figure was only based on the cash flows generated and did not include any social or environmental benefits. The analysis demonstrated a break-even accumulated cash flow after only 11 years (all investments are earned by in cash) with an unlimited flux of cash generated thereafter. There are no stock exchanges that offer similar investment opportunities!

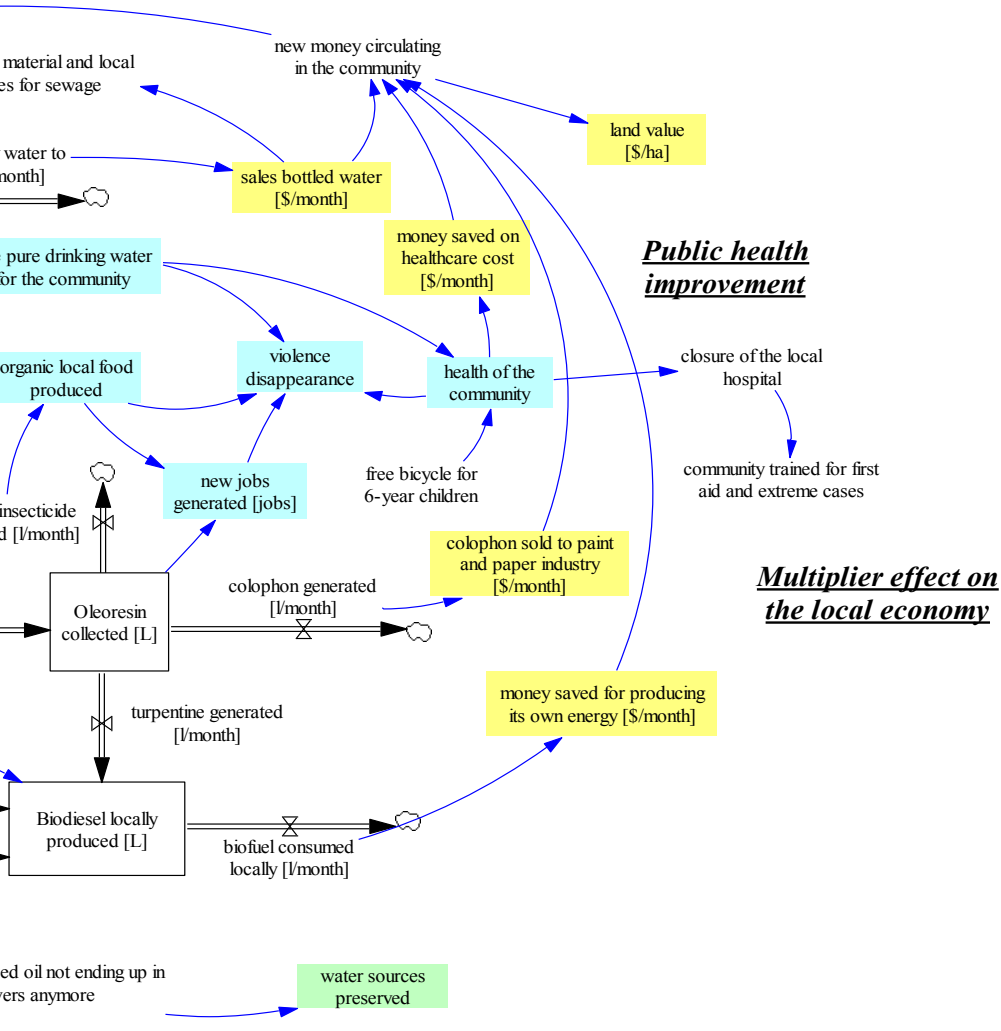
This program transforms land with no value into a regenerated ecosystem that provides food, wood, water and fuel, rebuilds the local

economy, improves health and generates jobs. That is an investment in transformation. This is the realm of investors we have named Captains of Legacy. The land is available, science has confirmed the concept, a major part of the home work is done, and the support of the government is solid. Formosa can be the starting point of environmental renaissance in Argentina!

Plan A

Clustering regeneration of forests with food and fuel




new money circulating in the community
material and local es for sewage
water to month]
sales bottled water [$/month]
land value [$/ha]
money saved on healthcare cost [$/month]
Public health improvement
pure drinking water for the community
organic local food produced
violence disappearance
health of the community
closure of the local hospital
community trained for first aid and extreme cases
insecticide d [l/month]
new jobs generated [jobs]
free bicycle for 6-year children
colophon sold to paint and paper industry [$/month]
Multiplier effect on the local economy
Oleoresin collected [L]
colophon generated [l/month]
money saved for producing its own energy [$/month]
turpentine generated [l/month]
Biodiesel locally produced [L]
biofuel consumed locally [l/month]
ed oil not ending up in vers anymore
water sources preserved

Fable 10

Oil growing on trees

The cover of land with trees is a necessity. The planet needs to balance the composition of the atmosphere and must at the same time regenerate this highly productive and protective layer of forests. This is not an altruistic program to save the world, this is an extraordinary effort to discover the products and services offered through the regrowth of a tree cover. When left to decide without any further human intervention, plants and trees will emerge that bear fruits and … even fuel, something we never expected. However, recent experiences of large scale regeneration of forests have confirmed that not only is the health of the people restored, there is also a remarkable discovery of biodiversity that demonstrates how ignorant we have been (and to some extend still are).

A Brazilian tree, the Copaiba, is visiting some relatives in California. They are enjoying a magnificent view of the Pacific coast. It is a good place to relax and discuss the future.

"Thank you for welcoming me to your home," the Copaiba says. "This is a wonderful country, but I do wonder how long California will survive, having to import so much water and fuel?"

"We earn so much money here in the United States, we could be considered one of the richest countries in the world! We can buy water and fuel from those who have it – and have people ship it to us," responds the Eupho tree.

"Well, you may be rich, but will there always be enough water and fuel in the world to satisfy your big – and ever growing – appetite?"

"If there is no longer enough, we will just plant more shrubs and trees," responds the Eupho, " and we will have all the fuel we need."

"Why would you wait until it is too late? You and I both know that when a tree is planted, it takes years before you can harvest it."

"You are right on all counts, you know. People consume too much fuel and pump too much water over long distances. And it is true: they do tend to act only when it is too late."

"The people living in the Amazon have been tapping me for ages," Copaiba says.

"They drill a little hole in my stem and the fresh diesel fuel that flows out can be put straight into an engine."

"You mean instead of going to the gas station, they stop by the tree and fill up? That is just a fantasy – but an interesting one! Hollywood would immediately make a movie about that," laughs Eupho.

"You can laugh all you like, but they had better first design cars that are very fuel efficient, instead of these guzzlers they drive around here. We can only offer twenty litres per tap, and then only maybe twice a year."

"Well, I am richer in fuel than you are," Eupho boasts.

"And I do not need to be in any lush rainforest in the Amazon to grow. I am able to grow on dry land – right here in California."

"Whenever one can have a local solution using a local plant, especially a friendly one like you, by all means, go for it! There is no need to look overseas."

"I have heard this question asked so often! What do you imagine those people, who make a lot of money from fuel now, think about this?"

"But surely all those rich people, who make a fortune selling petroleum, cannot stop a fuel like yours – one that uses the best Nature has to offer, without harming the Earth? Do they really not care about rising sea levels and climate change?" Copaiba wants to know.

"Well, it seems that they do not. They are just not willing to trade their Texan oil wells for Californian or Brazilian plants."

"It may be that the older generation does not care, but I am sure their children and grandchildren do."

... *And it only has just begun*!

The Opportunity
"Light-based Internet"

speed x 200
energy 80% less

Argentina has a unique chance to leapfrog connectivity to internet using the existing infrastructure of public street lights, and indoor illumination to offer high speed internet both in urban and rural setting. Energy savings fund the investment.

The French Government has decided to back this new internet medium staring with hospitals, schools and public transportation. The Paris Metro is the first in the world to convert all stations to LiFi ensuring mobility for the visually impaired (including foreign tourists).

Plan A

Chapter 10

The Next Generation of Internet

The Internet is a critical component of modernization. The online economy drives modern societies. And while this

unbridled growth has been ongoing for 25 years, it does not seem that there is any sign of slowing down. The 24/7 communication driven by Internet is one of the steadfast growth factors of the economy. It is no surprise that the energy consumption of online communication has risen from 1 to 2 percent of global energy consumption and it may even reach 6 percent by 2030. There always seems to be a downside to an upside.

This fast track roll-out of connectivity is a challenge for countries like Argentina that have an outdated infrastructure that does not even reach all the corners of the country and does not provide the necessary connectivity. Argentina deals with large youth unemployment. Young people are eager to embrace the world of hackers and gamers, 3D designers and passionate firmware writers but the brightest and most talented entrepreneurs leave the country to set up businesses in North America. Their home country lacks the infrastructure and the resources to develop their innovative initiatives. As is the case with Tomi Pierucci, Diego Saez-Gil and Alejo Vermin who created BlueSmart and raised all funds in the United States but kept a foot on the ground in Buenos Aires. It's a negative trend that could leave Argentina falling further behind.

A better digital communications infrastructure is the answer. The new 5G cellphone network, that has been in development for over a decade,

promises broader bandwidths and faster speeds by 2020. However, updating the Argentine networks to this new standard requires billions of dollars that the country doesn't have. Private investors are stepping in but that will only lead to higher rates that the large majority of the population cannot afford. And, strangely enough, 5G may not even be enough for countries that have the financial capacity to upgrade their mobile networks. It's estimated that a person in the industrialized world will own an average of 7 connected devices in 2025. A computer, a cell phone, a camera, a fridge, a car, keys, heating and cooling systems, security devices, gate and door controls, etc. Using artificial intelligence (AI) all these devices will talk to each other in "the Internet of Things" (IoT). In your car, you will find a message that there's no more milk in your fridge. On your phone, you turn the heat on in your apartment before you come home. The coffee will start brewing according to your roasting preferences while you are in the shower. And we are not even talking about millions of self-driving cars that one day may find their ways through constant communication over mobile networks. All that communication requires bandwidth. There are simply not enough frequencies below 10GHz—the spectrum used for all civil communication—to enable all this mobile traffic. The 5G network which promises a speed of one gigabit of data transmission per second seems already saturated before it's even officially launched.

These contradictory trends of failing to reach the poor as well as failing to meet the expectations of the well-to-do create a unique opportunity. We need additional frequencies. We also need to reduce the energy consumption of connectivity. Few people realize that each WiFi router consumes the equivalent of three good old 60-watt lamps that are kept on 24 hours a day. Offices and even homes have increasing numbers of routers. That's why—when it comes to electricity consumption—the Internet is the fastest growing sector. Something bold is required to reverse this. The good news is that there's a solution that meets both the need for added communication frequency capacity and the need to reduce energy consumption. The technology that has been invented in France in 2005

provides Argentina with an opportunity to bypass the investments in 3G, 4G and even 5G mobile networks and leapfrog to a future of fast and wide connectivity. It empowers the Argentinian Minister of Modernization to quickly embrace a breakthrough that is—on top of it all—cheap, since it can be funded with the energy savings.

Almost two hundred years ago, Samuel Morse demonstrated that it was possible to communicate over vast distances with light signals. By turning lights slowly on and off messages could be communicated, through the "Morse code", to a distant observer. If we multiply the speed of this blinking to 100 million times per second (100 MHz) enormous amounts of information can be transmitted at the speed of light invisible to the human eye. That's the invention of LiFi.

LiFi comes with many benefits. First of all, the introduction of LiFi reduces energy consumption with around 80 percent, and it offers additional services unimagined before. LiFi communication happens through LED lights that provide an immediate saving of power of 50 percent. A total savings of 80 percent can be achieved through intelligent energy management. When you leave a building, you turn off the light and immediately shut down energy consumption for lumens and data as the distribution of electricity and information is now operated through the same network. Incidentally, this makes hacking over the last meter and mile just about impossible. Data are transmitted through the existing electricity cables using current ADSL technology. The high-speed LiFi experience happens when the data are transmitted through the LED lights at the end of the cables. The same logic also applies in reverse: an optical fiber cable can be used to supply power limiting it all to just one cable… whatever is available.

Governments worldwide provide public light in towns and cities and along streets and roads. Light creates a sense of safety and helps to contain criminal behavior. The costs of public light are never an issue. Governments that need to cut expenses don't turn the lights off in the cities. This means that Argentina can introduce LiFi as a public connectivity service out of existing budgets without the need for any additional investment. The breakthrough

of LiFi is that it integrates high speed Internet into the public light system. In other words: There's an infrastructure that has already been paid for and there's a budget!

The energy savings make it possible to finance the conversion to LED and LiFi out of existing cash flow with a payback time between 3 and 5 years. And after that period, a better combined electricity and data service can be offered ongoing at 20 percent of today's costs. That is a game-changer for any country where the people are hungry for connectivity. Instead of facing the almost impossible challenge to upgrade an outdated infrastructure with billions of dollars that are not available, the country can now quickly and cheaply modernize its connectivity structure that is critical to support much-needed economic development.

The advantage of LiFi further increases when the old copper power cables are gradually replaced with glass fiber cables that can both carry 12-volt direct current and data. A glass fiber network allows for Internet communication at the speed of light—at least 200 times faster than the radio waves we are using today—but the critical point is that Argentina can hugely improve the speeds and capacity of the existing Internet infrastructure without the need for massive investments.

The introduction of LiFi means that every lamp post in the street with a LED bulb, the LED lights in public transit and in public buildings become Internet transmission points. Better every light turns into a satellite! There will be connectivity everywhere, there is speed and there are services the present system cannot provide with the same accuracy. And that geolocation will be highly precise. When three satellites are 20 to 40 kilometers in space locating a car, it is normal that there is a margin of error measure is meter, perhaps even ten meter.

If on the other hand a smart phone and two street lights only 6 to 8 meters away then the precision of determining the exact location of a moving (or still) object is unparalleled. Through the connection with the LED light your device will know exactly at the centimeter where it is. That's a different experience compared to the map app driven by GPS technology on your current mobile phone with a blue dot that nicely

dances in the vicinity of where you are and even disappears when you travel on the metro. A whole portfolio of geolocation services opens up valued at tens of billions of dollars.

That precision allows governments to offer valuable services. For instance: the visually impaired can be very precisely guided through the streets, public transportation and especially the metro. The same applies to visiting tourists who are navigating cities much like "blind" people. There are plenty of commercial applications as well. With LiFi it will be very easy to find the tabasco in the supermarket. You may be walking along the street when your phone will remind you that you are about to pass your favorite shoe store that is offering a sale. Searching for a parking place will be a thing of the past. When you enter the parking garage, LiFi will guide you to your spot. And you will never search in vain again for your car on the wrong floor of the garage. Yes, it can become annoying as well but there's always an "off" switch. The important point is that LiFi offers a new platform that allows for localized services.

LiFi will change business as well. Today, all goods in warehouses need to be scanned so that can be located and cashiers scan the products you buy in the supermarket. In the near future, a little diode will replace bar and QR codes on all products. That means that all products will be able to communicate with the LED lights and there's no need to scan anymore. You always know where everything is and the tiny battery will power the tiny "here I am"-call for at least ten years.

When a new platform emerges, there's an opportunity to change the rules of the game. And it's time that the rules are changed when it comes to data collection and the related financial benefits. Today, almost all "Big Data" are controlled by a handful American Internet giants: Google, Apple, Microsoft, Facebook, etc. In return for an email address, and/or in return for the service to freely browse the Internet, we give all our personal data away for free to these companies that now increasingly control our lives and make a lot of money because they can sell very precise information about our behavior. You would be surprised and most certainly protest if someone were able to use your liver—or another part of your body—for

free and without your permission. However, you don't own a large part of your mind. You don't fully own the (financial) power of the choices you make. That's an unhealthy situation that LiFi could change.

LiFi brings the data to you—you don't need to search anymore. Does this mean that you don't need Google anymore?. You make your shopping list on your phone and whenever you are getting close to a store that has something that is on your list, LiFi will tell you that you need to visit that store. The same applies to governments and the public domain. When a tourist arrives in Buenos Aires, he knows nothing and uses his phone to find out where his hotel is etc. Guess who makes money on these searches? Google! Not the city of Buenos Aires that provides the information for free. Google doesn't know where the hotel of the tourist is. Google doesn't know the public transit system. Google doesn't have all that information. The genius of the search giant is its ability to bring all that information together in a search engine operated platform that is controlled by… Google.

The introduction of LiFi makes it possible to bring information back under the control of those who are the source it. We will recover the vote that we lost. When a local government invests in new light systems, it can control the distribution of local data through local LiFi networks. That allows local communities to own their information, and exchange it with those who share the benefits, and to deliver data and information precisely to those who should receive it, while others consider that spam. Better, the value of the street lights which was calculated as a cost to the community now turns into a valuable asset.

An additional advantage of LiFi is that it provides much better security from external hacking. Unlike radio waves, light waves—LiFi signals—don't travel through walls. That means a signal is contained in the room or at the location. Out of the reach of the light beam, there's no personal connection.

Light waves are less invasive and that leads to another important benefit of LiFi. There's increasing concern about the impact electromagnetic fields caused by mobile phone radio wave networks particularly on children. For example, recently, the European Commission issued a strong

recommendation to limit the exposure to a maximum of 0.62 Volt per square meter. The French parliament has set that level as a legal standard. California is imposing strict limitations to the use of radio waves.

However, research shows that exposure can be much higher in many places. Radio waves can disrupt cell to cell communication in our bodies and that disruption can cause disease. Again, LiFi waves don't interfere with body frequencies. Some have gone as far as to claim that the debate around the health impact of radio waves is comparable to the discussions around smoking in the 70s. The industry knows that damage is created, but recognizes that any limitation will hinder their profitable business margins and therefore lobby and resist.

Light waves also don't interfere with equipment. A common problem in hospitals is, for instance, that an excess of competing radio waves could disturb the functioning of critical medical equipment. A brief disturbance in an electrical system can change a critical dose of medicine fed through an automated drip. This needs to be avoided at all cost.

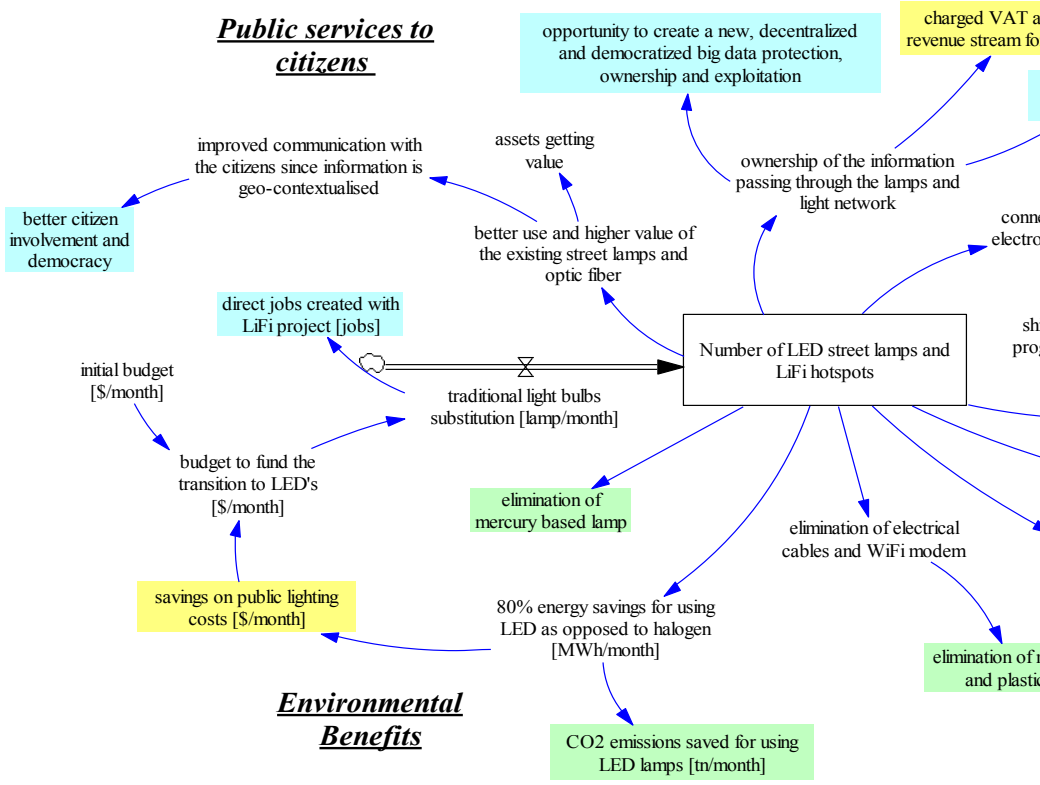
LiFi offers a perfect and healthy solution for communication and connectivity within hospitals. To set up a LiFi network in the average hospital costs about 300,000 dollars. And that investment can be paid back in 3 to 5 years out of the energy savings. There are additional efficiency savings and new services as it will be easy for hospital staff to locate equipment, medicines etc. Today, nurses lose substantial time going from room to room searching for the equipment and/or medicines they need.

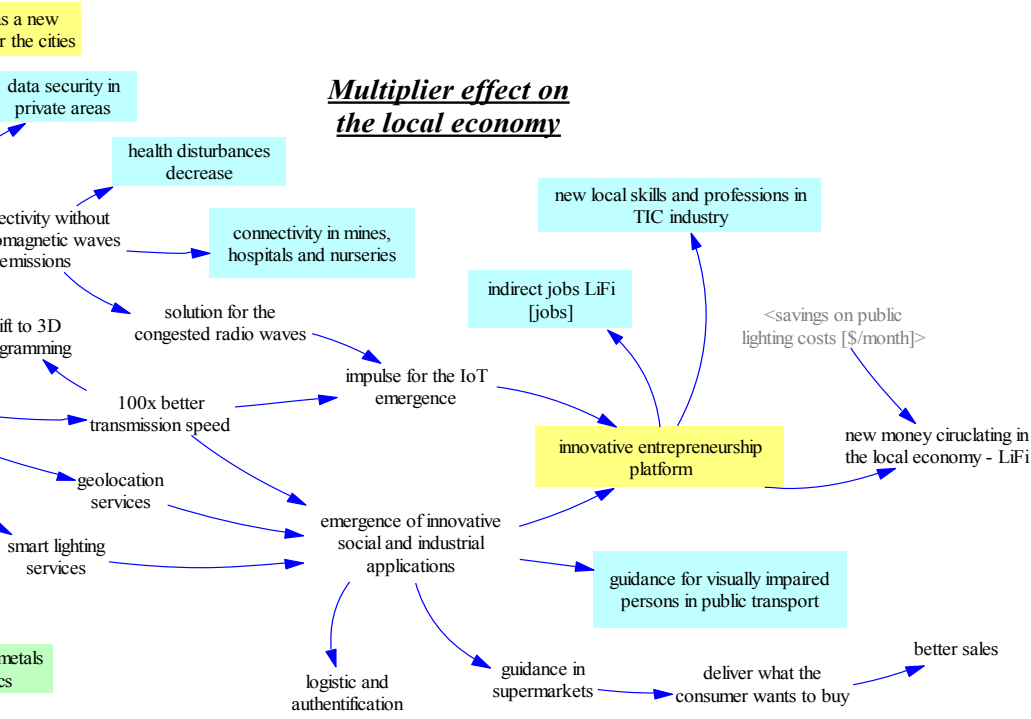
People who are first introduced to LiFi tend to think that it is the next version of the Wifi they are familiar with. The interpretation is obviously inspired by the similarity of the names. But LiFi is not a replacement for WiFi. LiFi offers a completely new platform for connectivity with different services and different players.

Argentina could embark on a rapid modernization plan to launch LiFi initially in a few cities and a few rural communities where there is no connectivity at all, as a starting point for a nationwide rollout. LiFi offers the country a unique opportunity to join the core of the global Internet economy that drives innovation and economic growth. The country can make this

jump without the need for billions of dollars of investments to upgrade the existing infrastructure. It can simply turn an available asset with low value—the existing public light network—into a new platform for the delivery of numerous valuable services. Argentina can do more with what it already has. It can create more connectivity which means more economic development and more income for its citizens and communities. Metro stations, hospitals and schools can be converted quickly, and hundreds of schools that had no power and no connectivity can now leapfrog and bring modernity to the Internet of everyone! And the bill for this is paid by the energy savings. That is the kind of budget intervention that Governments with tight budgets enjoy. This is the kind of investments any investor would like to participate in.

Clustering energy savings with hi-speed Internet

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100x better transmission speed
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new money ciruclating in the local economy - LiFi
geolocation services
smart lighting services
emergence of innovative social and industrial applications
guidance for visually impaired persons in public transport
metals
cs
logistic and authentification
guidance in supermarkets
deliver what the consumer wants to buy
better sales

Fable 11

At the speed of light

We all learn in school that the fastest measurable speed is that of light. And yet, we do not use it. We all learned the coded message of SOS, translated into Morse (. . . - - - . . .) and yet we do not use it anymore. The opportunity to complement the present infrastructure of radio communications through WiFi, 3-4-5G, Bluetooth, hotspots and the like is an opportunity to do more than only offer yet another way to connect. It is a means to save energy (and fund the investment), it reduces the health risks, provides new services and protects data, putting the responsibility back into the hands of the people who provided the data in the first place.

The owl is sitting on his branch, high up in the tree and notices that everyone is watching their personal screen. He spots one rat that is looking at the sky.

"Don't you have one of these things that connects you to the world" remarks the owl.

"I do not know why everyone is so keen on getting to the Internet."

"Internet: you mean the network that connects everyone to everything, puts you in touch with all the wisdom and all the experiences around the world."

"I think that people who only look at what is out there on the other side through these little screens, forget to look at what is here next to us."

"People are so connected and can learn so much about each other. That makes the world much smaller."

"Connected? I think it makes the world dumb."

"That is not true, and certainly not very nice to say."

"Well I see families over breakfast, couples in restaurants, kids in the car and everyone is glued to their screen. We don't discover anymore what we have. We even have forgotten how to look people in the eyes, and smile."

"I know: a wonderful and honest smile is contagious. However, thanks to the Internet you can instantly figure out what the weather will be or where you can buy a book. That is progress."

"Progress? Is it really better when you can order a book and have it delivered to your home, and get a like on your page? I prefer a visit to the local bookstore and a tap on my shoulder from those who really care."

"You will not be able to stop this Internet. Everything that we have will be connected through the cloud!"

"And how will these things communicate?"

"It all works like a radio: sound and radio waves."

"If I ever want to communicate, then I want to do this at the speed of light."

"Light is the fastest, but it has no Internet."

"Have you ever wondered why we use radio waves that jam the air, confuse the birds, and give us headaches?"

"But, soon we will have self-driving cars; we can see if our children are happy and safe asleep at home while we are out in the forest."

"Why do you want to drive a car by connecting cameras to satellites, when you have street lights and headlamps?"

"Because smart people put satellites in orbit, and have cameras that can look all around you!"

"Look, I'm tired of people celebrating expensive technologies for the rich, I want safe streets with lights, cars that talk to each other to be safe on the road. And most important, I want to enjoy breakfast with the family again."

... *And it only has just begun*!

Epilogue

This book is but a 50,000 words summary of the full reports where were prepared by the Argentinian Chapter of the Club of Rome under our guidance. These report and their annexes total over 2,400 pages and offer an overload of details that constitute the bulk of information submitted to the Government. Each chapter of perhaps 10 to 20 pages in this book has a ten-fold of analysis and data to support it.

The 10 sectors and four fields of action are only a first review. More detailed assessments of the identified initiatives are required. This Plan A offers a direction, and once a few concrete results have been obtained, then others will quickly emerge.

However we all know the dilemma of a bulky and loaded set of reports … it takes time to read. Therefore those who are keen to learn more about each of the projects, from the pre-feasibility study and profit and loss statement made for stone paper, or want to establish contact with the core members of the Argentinian mushroom farming, and would like to visit one of the project sites, then feel free to contact the Argentinian Ministry of Environment and Sustainable Development at EconomíaAzul@ ambiente.gob.ar.

We believe that the next steps of this endeavor is to ensure that entrpeneurs are inspired, that the investors follow and the Government creates the framework to facilitate action. There is a huge task before us: share the insights and improve the proposals but in the mean time let

us make certain that the perfect does not stand in the way of the good. Initiatives must unfold, and decisions to proceed must be taken.

The ZERI Network is prepared to support this process in any way it can, knowing that its success will be measured (internally) by its obsolescence: the faster the core team members are not needed anymore, the better job we have performed since this implies that local experts and entrepreneurs have taken over the leadership.

Fable 12

The strongest tree

A nice your oak tree wonders: "How can I ever be the strongest tree in this forest?

The more leaves I have, the more energy I get from the sun.

The more leaves I have, the more leaves will fall to the ground.

Ants, earthworms, and mushrooms convert the leaves into new food for me.

The more food I have, the more fruit I can grow.

The more fruit, the more birds will visit me.

The more birds, the more droppings, the more droppings, the more bacteria in the soil.

Many more soil bacteria will enrich the ground water.

The more food in the water, the more flowers will grow; the more flowers - the more bees.

The more bees, the more pollination, the more seeds.

With more procreation of everyone, my family and I are the strongest in the forest.

Everyone gives me many gifts that have been made from things that I did not need or would have been waste.

All of these actions contribute to me being the strongest - even though some are small, some are ugly, and some I do not even know the difference between their head and their tail.

If I were to chase the earthworms away, because I do not like or understand them, I could not be the strongest tree in the forest.

If you give away what you do not need - you get a lot back, and all together, we can be the best."

The strongest tree gives what is not needed and in return, receives benefits from others.

The tree realizes that everyone can help from the smallest to the most beautiful and perhaps even the ugliest.

... *And it only has just begun*!

Plan A

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About the author and the editor

Gunter Pauli (1956) is an established author who published his first books in 1987. His latest sequel of three editions of *The Blue Economy* has been translated into 43 languages and has reached over a million readers. Pauli is an entrepreneur who embraces groundbreaking and pioneering initiatives. While *The Huffington Post* named him the Steve Jobs of sustainability, his Latin American friends often refer to him as the Che Guevara of sustainability. He is dedicated to the transformation of society, designs a fundamentally new business model, and goes out of his way to turn vision into reality. Pauli witnessed, learned from, pushed forward, and/or started up over 200 projects in every corner of the world. He identified 12 trends that explain why these initiatives have taken ground, expand, and speed up. Pauli surfs the waves, intuitively thriving on the transformative and unstoppable trends that no statistics or big data seem to identify. Pauli believes that the transformation of society only succeeds when we reach out and inspire children at an early age. He has written about 280 fables based on an agreement with the Chinese Government, which has committed to publish 365 by 2022. He is a father of six, married to Katherine Bach, and has resided in Japan since 1994.

Jurriaan Kamp (1959) left a successful career as South Asia correspondent and chief economics editor at the leading Dutch newspaper, *NRC Handelsblad*, to found the "solutions journalism" magazine *Ode* which was later re-named *The Intelligent Optimist*. Under his guidance, the magazine has more than once won the prestigious Maggie Award for journalism. In 2015, Kamp launched a daily online solutions news service, *The Optimist Daily*. Kamp has regularly come in ahead of the curve on stories that advance new visions of our world including a "More and Better" approach to sustainability. He published *Because People Matter: Building an Economy that Works for Everyone; Small Change: How Fifty Dollars Changes the World*; and most recently *The Intelligent Optimist's Guide to Life: How to find health and success in a world that's a better place than you think*. Kamp studied international law at Leiden University in the Netherlands. He is a father of four and lives with his beloved, Nancy McGrath, in Santa Barbara, California.

François Nolet (1993) graduated from ICHEC Business School in Brussels, Belgium in 2017. During his studies he decided to get practical experience and joined the project team in Colombia to work on the integrated biosystems, mining and larvae initiatives. He studied the mathematical modelling of system dynamics and after visiting Argentina, he converted the 10 projects in this book into models that demonstrate the potential of the transformation.

Also by Gunter Pauli

Crusader for the Future: A Portrait of Aurelio Peccei, Founder of the Club of Rome (Pergamon Press, 1987)

Steering Business Toward Sustainability, edited with Fritjof Capra (United Nations University Press, 1995)

Breakthroughs: What Business can Offer Society (1997, Greenleaf Press)

Upsizing: The Road to Zero Emissions (1999, Riemann Verlag)

Out of the Box: 21 ways to be creative and innovative at work (2001)

Zen and the Art of Blue (Commonwealth Press, 2004)

The Blue Economy (Paradigm Press, 2010)

The Blue Economy 2.0 (Academic Press, 2014)

The Blue Economy 3.0 (iXlibris, 2017)

The Third Dimension: 3D Farming and 11 More Unstoppable Trends that are Revolutionizing the Production of Food and Fuel, Regenerating Nature, and Rebuilding Communities

LiFi: The Internet at the Speed of Light (JJK Books, 2018)

For further information

www.zeri.org

www.TheBlueEconomy.org

www.GuntersFables.org

Plan A

For ordering books
The Blue Economy
https://www.xlibris.com/Bookstore/BookDetail.aspx?BookId=SKU-001116131

The Third Dimension
LiFi
www.jjkbooks.com

The hundreds of fables that translate breakthrough innovations into reality for children

The fables are available on <www.TheFableShop.com>

Every insight into sciences, every design of a new business model, every problem that had to be overcome, every ethical question asked, every breakthrough achieved, every person to be celebrated as described in book The Blue Economy is translated into a fable for children. As of August 2017, some 280 fables have been written, and 180 have been published. Digital, audio, and print (also print on demand) is available in multiple languages. Check the site for what would be of interest to you. When all 365 fables are expected to be ready (by 2022), the information contained will be like an encyclopedia of life with science, emotions, arts, connected thinking, and the power to move on to action.

Plan A

The Transformation of Argentina´s Economy

Argentina is a nation at crossroads. The country is a very successful food exporter. At the same time, Argentina faces major challenges including high unemployment, malnutrition in certain portions of society while Internet connectivity remains a privilege of a few. Economic success fails to reach all layers of society. The good news is that Argentina has a huge potential to increase its productivity using waste and untapped resources the country has in abundance.

This book identifies 10 innovative business models that will transform the nation. It shows that dramatic shifts in food, energy, mining, construction, paper and communications can respond to the needs of the people while leading the economy towards sustainability. These 10 cases present attractive opportunities for investors searching to become "captains of legacy" and will put Argentina on the map as an inspiring example and leading pioneer for other countries —aiming for economic transformation— to follow.

GUNTER PAULI
author

Gunter Pauli (1956) embraces groundbreaking and pioneering initiatives. Over the past 40 years he created 12 companies (2 failed) and leads since 1994 a network of scholars (Think Tank) and entrepreneurs (Do Tank) known as The ZERI Network. He accompanied, supported, and sometimes personally started over 200 transformative initiatives worldwide. He identifies portfolios of opportunities based on solid science and entrepreneurial acumen supported by investors keen on changing the rules of the game. His latest book, The Blue Economy, has been translated into 43 languages and has reached over a million readers. While The Huffington Post named him the Steve Jobs of sustainability, his Latin American friends often refer to him as the Che Guevara of sustainability. He visited Argentina first in 1976 and has returned nearly fifty times.

JURRIAAN KAMP
editor

Jurriaan Kamp (1959) left a successful career as South Asia correspondent and chief economics editor at the leading Dutch newspaper, NRC Handelsblad, to found the "solutions journalism" magazine Ode which was later re-named The Intelligent Optimist. In 2015, Kamp launched a daily online solutions news service, The Optimist Daily. Kamp has regularly come in ahead of the curve on stories that advance new visions of our world including a solutions-oriented, optimistic approach of the challenges of sustainability.