

PRODUCE MORE WITH LESS WITHIN

AN AGRO-ECOLOGICAL FRAMEWORK:

***EFFICIENTLY HARNESSING OUR BIOLOGICAL
CAPITAL AS LIVING SYSTEMS***

*Fr. Godfrey Nzamujo O.P (Prof. Eng.)
Director of Songhai Center*



To a large extent, in Africa we have succumbed to a logic of poverty or underdevelopment, simply because we are no longer capable of internally generating the capacities to build the appropriate institutions and structures that will enable us to consistently produce the social values, goods, and services that correspond to our needs and desires. Passive consumerism, shallow and piecemeal solutions, and the quick adoption of other peoples' experiences, solutions, systems of production, and values have become cheap substitutes for doing the hard work of growing up and developing native competencies and processes that would guarantee sustainable, broad-based and inclusive growth on the African continent.

Indeed, when a community is no longer able to generate, on its own, the forces to continually face and meet its needs and desires within a given environment, this community has run into a logic of poverty or under development.

If on the other hand, a community becomes capable of continually unleashing its internal forces and building the appropriate environments or structures to enable it to face and meet its needs and desires, in spite of its internal and external constraints and challenges, then this community is solidly engaged in an process of development.

An important idea that must be appropriated in any authentic development process is that there are no generic solutions. Every age and environment is unique and the solutions must be unique and contextualized. This definitely throws a light on how best to view and face the challenges of our time to provide appropriate solutions.

Another essential element in this process is to realize that the crisis we are facing today is totally different from what we have seen before. It is not just one or two problems scattered here and there. This crisis is global and multifaceted.

I will suggest that we as a people must make efforts to view this crisis in the context and dynamics of the long-term evolution of our human societies. This endeavor (long-term historical evaluation) could

help us to realize that this crisis could constitute a turning point in our collective history. Indeed, this present crisis could present new opportunity sets for our people. Indeed, what really defines a people and what determines who they are, depends not only on how they perceive their challenges, but also how they face and react to them.

“At any given moment you have the power to say this is not how the story is going to end. Anonymous” That is what I call growing up.

A closer look at what we presently see as multiple crises (food security/poverty, difficult demographic transition/youth unemployment and environmental changes.), reveals that they are all connected - suggesting that we have before us, **a systemic problem (a complex crisis) that requires a holistic and broad-based approach**. This is like a monster with at least three heads.

Unfortunately most of the solutions we have seen so far seem to be piecemeal and symptomatic therapies that hardly work. In the best cases, these solutions are simply Band-Aid endeavors. In most cases, however, they end up creating more problems.

It is however refreshing to note that more and more people are now realizing that we have hit a point in history that calls for dynamics and orientations that are deeper and broader than any attempts we have seen so far. Today's challenges require a radical shift not just in our vision of the world or our mentality and how we think, but in every sphere of our lives - from the way we see ourselves and relate to each other; from our relationship with the environment to our intellectual, scientific, technical and business orientations; from our production systems to the ways we exchange and consume our products and services.

BUSINESS AS USUAL IS NO LONGER A VIABLE OPTION

It should be new wine in a new wine skin.

We need a new road map, a new compass

- The disheartening socio-economic situation today, I think, will continue and will definitely get worse if we continue to navigate with the same "old map". We have been operating from a mechanistic paradigm developed centuries ago. Our compass is not pointing to the "True North". This "wrong map," developed and adopted slowly since the beginning of the first industrial revolution engineered by the Cartesian mechanistic worldview, is not going to be of much help to us today..
- Another major step is to determine how to build the appropriate institutional framework and raise the human resource base that will be capable of harnessing the opportunity sets as the new paradigm dawns on us.
- *In other words, the challenge before us now is how to appropriate and align ourselves with the emerging world view and create an enabling institutional framework that will enable us to*

unleash the production of a critical mass of a new human resource pool that is equipped with the right vision, values, and operational capacities to help us navigate through this difficult and challenging period in our history. Isn't this the raison d'être of our universities?

Are our universities up to this challenge?

PARADIGM SHIFT

I am convinced that the solutions to our problems today can no longer be found in our present day attitudes and logic. We should see our lives as a part of a difficult mission of developing new mental and operational frameworks that are based on what we now know about how our world works. Modern sciences, among other sources, including the neurosciences, cognitive, biological sciences etc. are providing us with fundamentally different and refreshing frameworks about our own human dynamics, as well as those of our planet.

From these sources, **a new paradigm** is emerging. This new paradigm has a completely new and different technological, organizational, and socio-economic orientation. This paradigm is challenging us to learn from the basic principles of the workings of our planet and human history. We believe that by seeing our problems from this new world view, we will be in a better position to design and re-engineer our way out of our current crises. This new paradigm must be appropriated and deployed by a critical mass of our people if we are really committed to creating, designing, and inventing organizations, industries, and economic activities that will solve our present day problems.

The big question is this: *What leadership role can our universities and intellectual communities play in moving us from our present mindset and logic of poverty to the new world view?*

Are they equipped and willing to play this role?

The Third Industrial Revolution (TIR) is already upon us:

There are three pillars in this new world view. Together they constitute the new foundation of the Third Industrial Revolution (TIR), which must get underway if we are to re-engage in a sustainable pathway. These pillars are:

- 1) Distributed energy regime (material and non-material)
- 2) Synthropic connectivity within the new energy regime:
The Information and communication technology is a driving force or steroid of this process.

Some of the principles at play within this new regime are:

- ***Synergy,***
 - ***Symbiosis***
 - ***Complementarity, Collaboration, and Suplementarity***
- 3) Rediscovering and harnessing of the biological capital of the universe as living systems.

BUILDING KNOWLEDGE, SCIENCE AND TECHNOLOGY IN DISTRIBUTED SOCIO-ECONOMIC INSTITUTIONS

The idea of sustainable and balanced development (economic, social, environmental, and political) being an overriding force in the determination of the trajectory and orientation of scientific development is not something new. Aristotle and Greeks got it figured out years ago. Let us revisit the Hellenistic origin of this idea:

- **Episteme:** this means scientific knowledge, or understanding the principles. The English word 'epistemology' is derived from this root. You could describe this as being the 'know-what' of a subject.

What are the modern sciences, especially the biological sciences, cognitive sciences, and neurosciences telling us today? What is the quality of the scientific investigations in our universities today?

Are we not far behind in this domain? Are we investing enough to build the required critical mass of functional scientists?

- **Techne:** This means having the skills to practically do something, to use knowledge to make something happen. The English words 'technique' and 'technology' come from this word. This is the 'know-how' of a subject. Enterprising/entrepreneurship

Are we turning out builders, entrepreneurs and inventors?

Here again, our graduates are not functional. Most of their training is academic and far removed from reality.

- **Phrenesis:** Sadly, there is no direct translation of this idea in English (which is a great pity). It indicates understanding of when and how to apply the other forms of knowledge, based on a moral, social, spiritual, and even environmental appreciation of the world. In English, we could use 'Wisdom', 'Experience', 'Contextual understanding', 'Value-driven' or some other such phrase. This is the 'know-why' of a subject.

How can Phrenesis become a part of our university formation program?

You could say that since the scientific revolutions of the Enlightenment (episteme) and then the Industrial Revolutions (techne), two forms of knowledge have had amazing flowerings, transforming the world. However, the wisdom of our species to apply this knowledge (phrenesis) to benefit all people, future generations and the planet is still desperately lacking.

SUSTAINABLE DEVELOPMENT

As you can see, phrenesis is not just the wise application of science and technology for the good of humanity, it is foremost a mental framework, a world view, a disposition, a way of life. This is the core element of what we call sustainable development. The technologies tailored to promote sustainable development are what we call sustainable technologies.

Sustainable technologies and the right vision/ world view therefore will constitute the fundamental resources that we need to response to the challenges of Poverty/food security, demographic transition/youth empowerment and the environmental crisis all of which are the focus of the UN Millennium Development Goals.

The concept of sustainable development implies that we can increase our productivity, while protecting and enhancing our environment.

Given our present situation, we have two inescapable lines of action:

- **1- Urgently increase the capacity of production of Africans through using leapfrogging technologies**
- **2- Re-design our production and development systems, based on our new understanding of nature and sustainability, to ensure that future generation's right to a healthy and productive environment is not compromised. (PHRENESIS)**

REVISITING AND HARNESSING OUR BIOLOGICAL CAPITAL AS LIVING SYSTEMS

PRODUCING MORE WITH LESS WITHIN THE FRAMEWORK OF AGRO-ECOLOGY

As we stated earlier, our present problems originated from the way we see the world, that is – from a mechanistic consciousness, an outmoded world view that does not correspond to the realities and challenges of today. These problems will therefore not be solved operating from the same frame of mind that created it in the first place. It is like looking for Ile Ife on a map of Cross River.

- *It is a question of a new wine in an old wine skin*

Our modern industries, especially in the agricultural sector, are inefficient both in terms of output per unit input and in absolute terms.

- They end up generating a lot of wastes and entropy, and depleting energy and other resources
- We need therefore to stop seeing our problems from a 17th century consciousness and begin to explore what we now know in the 21st century.

One of the fundamental elements in what we now know about our world is the concept of life, the web or network and relationship and energy pathway in this web of life:

- 1. The interdependent relationship among all living things.*
- 2. The flow of energy permeating this web of Life.*
- 3 The concentration of energy at nodes (sub-systems)*
- 4. The cyclical displacement of elements and nodes within this web.*

We now know that we have three space dimensions and the time dimension as our new playing field. But these extensive space-time dimensions cannot be harnessed in the old paradigm. The new science calls for a closed system that holds its resources within to service all available sub-systems. In this space, organisms, life cycles and processes, nodes and sub-nodes don't need to compete for space and resources. They don't have to grow at the expense of each other.

This unfortunately, is not the case with our present socio-economic model, especially the conventional agricultural model. Our current model is of struggle and infinite competition. It is the survival of the fittest.

We all recognize the fact that the advent of the present day conventional agriculture based on the intensive use of chemicals has increased global food production and the average per capita food consumption. In the process however, this practice has depleted and damaged the resources of many agro-ecosystem, jeopardizing future productivity and aggravated the environmental challenges (greenhouse gases, water pollution etc.) of our time.

Even with its advances, this agricultural system has not significantly reduced the number of chronically hungers which is currently estimated at about 870 million people.

It is now evident that this system of production cannot meet the challenges of our time, especially in Africa. The Songhai system is a part of the search to develop and deploy a new paradigm that harnesses the environmental capitals of our planet to produce more and better quality food for a growing population, while protecting and enhancing our environmental capital.

The Songhai regenerative agriculture promotes the real "greening" of Agriculture, through an ecosystem approach that draws nature's contributions to crop and animal growth, such as soil organic matter and soil micro-organisms, rainfall, pollination and bio-control and integrated pest management, Eco services (water shade and landscape).

Our space-time can be filled up more thickly and more efficiently with life cycles of different sizes that occupy different space-times. This is exactly what organisms in a naturally bio diverse ecosystems do to maximize the reciprocal, symbiotic, complimentary, supplementary, and synergetic relationships that enhance the performance of all.

If economic activities must increase in a leapfrogging manner, say about tenfold over what is needed today to support a population that will double its size in a few years, then technology will have to reduce its impact on the environment by about twentyfold – this will be a huge technological challenge in matters of environmental sustainability, but also will be an open field for creativity and innovation. In other words, a “license to create” environment will be wide open.

Sustainable technology and sustainable development will therefore constitute one of the biggest technological and commercial opportunities in the years to come.

The concept of sustainable development implies that we can increase our productivity, while protecting and enhancing our environment. **PRODUCING MORE WITH LESS**

These technologies will enable our agricultural sectors to produce more with less. This is only possible if we have an integrated system of production where the principles of synergy, complementarity, supplementarity, and negative entropy are in play.

These principles will enable us to create products and services, even at molecular levels, that hold the potential to dramatically increase productivity, insure nutritional quality, and eliminate waste and pollution.

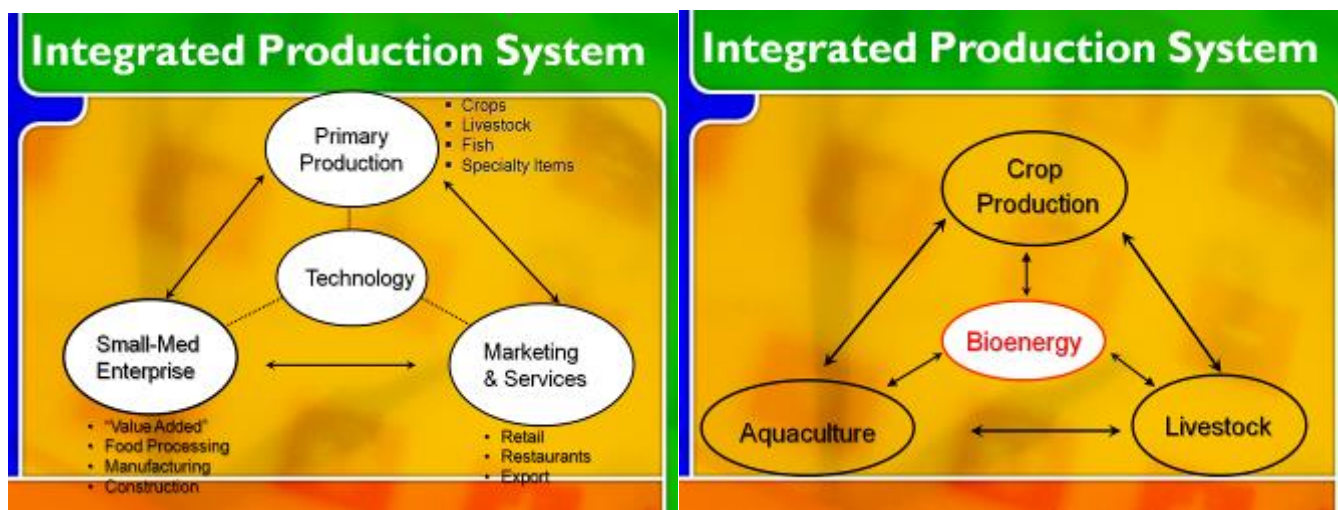
The Songhai initiative is basically the harnessing of these principles to invent and develop new and appropriate technological and developmental trajectories. It is an integrated development system that organically creates dynamic forward and backward linkages and synergy between agriculture, Industry, and services - and also within each of these sub-systems.

Songhai develops and promotes a process that strives to harness the regenerative forces/elements in nature to develop an agriculture that is not only multidimensional and multifunctional, but also enhances benevolent cycles and pathways as it-

- a) Produces food in sufficient quantities and with qualities that promote healthy living, healthy aging, and disease prevention**
- b) Enhances the environment (soil life, food web, soil structure, etc)**
- c) Builds sustainability and biodiversity.**
- d) Provides raw materials for Agro-Industry**
- e) Provides feed stock for renewable energy**
- f) Creates employment, particularly for youths and women**

The merits of a development strategy based on this type of agriculture are not only safe, affordable, high yield, high quality and sustainable, it also addresses employment and environmental problems in both rural and urban areas and builds a strong base for an inclusive and broad-based economy.

A major value proposition in this endeavor is that as it breaks the vicious cycle of poverty, it counters the “scarcity syndrome” in the developing countries that underpins socio-economic conflicts by developing a **natural and integrated farming system that is based on low cost inputs and by recycling by-products and wastes, thanks to the deployment of microorganisms.**



Regenerative Green Technology and super soil development at Songhai constitute a part of our drive to develop authentic technologies that bring into play the natural forces of synergy and amplification (enzymatic actions) in nature that have been ignored by conventional methods.

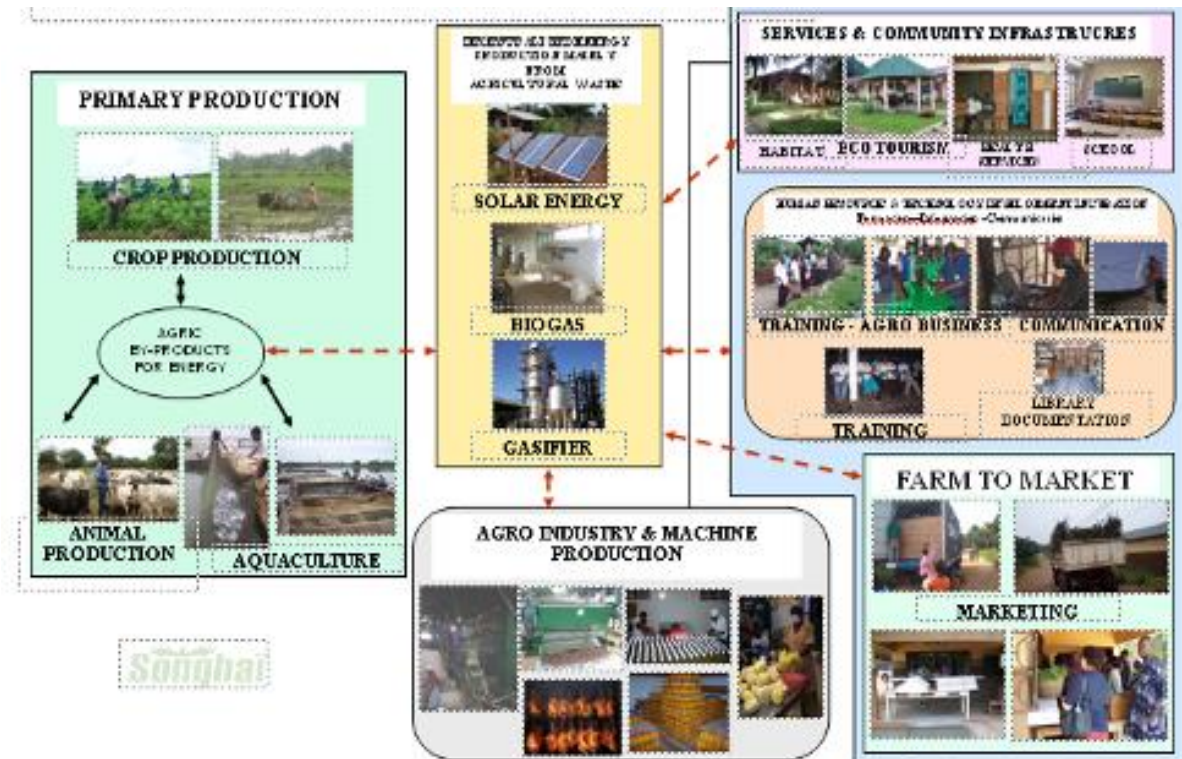
This method creates a pro-biotic environment that empowers the regenerative agents of nature. These agents are capable of creating “reverse entropy”- SYNTROPY- and the “super enabling” conditions and environments like enzymatic actions, appropriate pH conditions etc. It is **“PRODUCING MORE WITH LESS”**.



It is therefore clear that this agriculture will no longer be primarily a chemical process, like conventional agriculture. Instead it will be largely a biological process where our incredible environmental and biological capitals are fully engaged and harnessed.

We have therefore to relearn the way we practice agriculture from the way we view the soil and its fertility, through the way we maintain, nourish, and protect our plants and animals, to the way we condition and market them.

We must therefore learn how to harness our environmental capital and turn the rural sector around to become productive, efficient and remunerative. The collateral effects of this broad based approach will constitute the leverage point and fertile ground for meaningful employment in the different sectors of the economy (primary, secondary and tertiary). This will eventually trigger a reversal of the massive rural exodus in the region. In other words, a sustainable and integrated Agriculture is an inescapable pathway to a viable, **broad-based and inclusive** economy.



GREEN RURAL CITIES COULD BECOME NEW HUMAN SETTLEMENT MODEL OF THE FUTURE

WHEN WE CHANGE THE WAY WE GROW OUR FOOD, WE CHANGE OURSELVES, WE CHANGE OUR VALUES, WE CHANGE OUR SOCIETY

Unlocking the potentials of the environmental capital of Africa through the development of:

- **Super soils**
- **Genetic inputs (biodiversity) as key in our environmental capital**
- **Natural genetic protection using microorganisms beneficial insects and plant extracts**

The fundamental error to rely solely on genetic modification is the failure to recognize the fact that when these GMOs (Genetically-Modified Organisms) are confronted with inappropriate environmental conditions, the genes immediately switch off and cease to function. In most cases, if we force these genes to switch on, this can actually disrupt other functions that may bring very adverse effects. The key to facing the present challenges of agricultural productivity is THE SOIL.

Healthy living soils which we refer to as “super soils”, **create an enabling environment that enhances synergy and pro-biotic activities.** When the plant is enabled to take command of its environment and community of myriads of micro-organisms, this creates co-existence that triggers co-prosperity. Many plants genes will switch on automatically and, in many cases, ordinary varieties will be transformed into super seeds and super crops.

We believe that without this fundamental shift in our agriculture, our future will be seriously compromised.

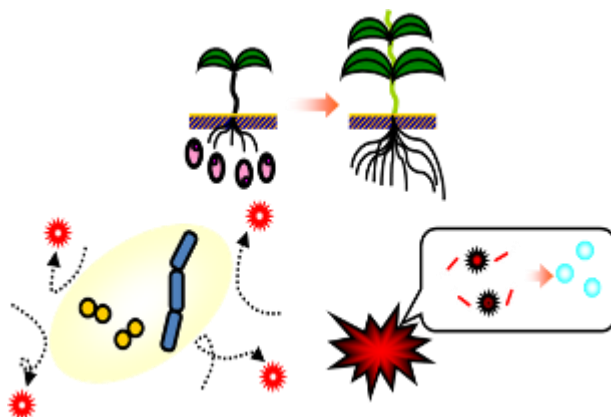
Harnessing our incredible biological capital

Central to this technology is a group of microorganisms with syntropic characteristics. These integrative and synergetic groups develop co-existence dynamics that bring about co-prosperity as they support each other and produce bioactive substances and environments that enhance production.

A typical group will include:

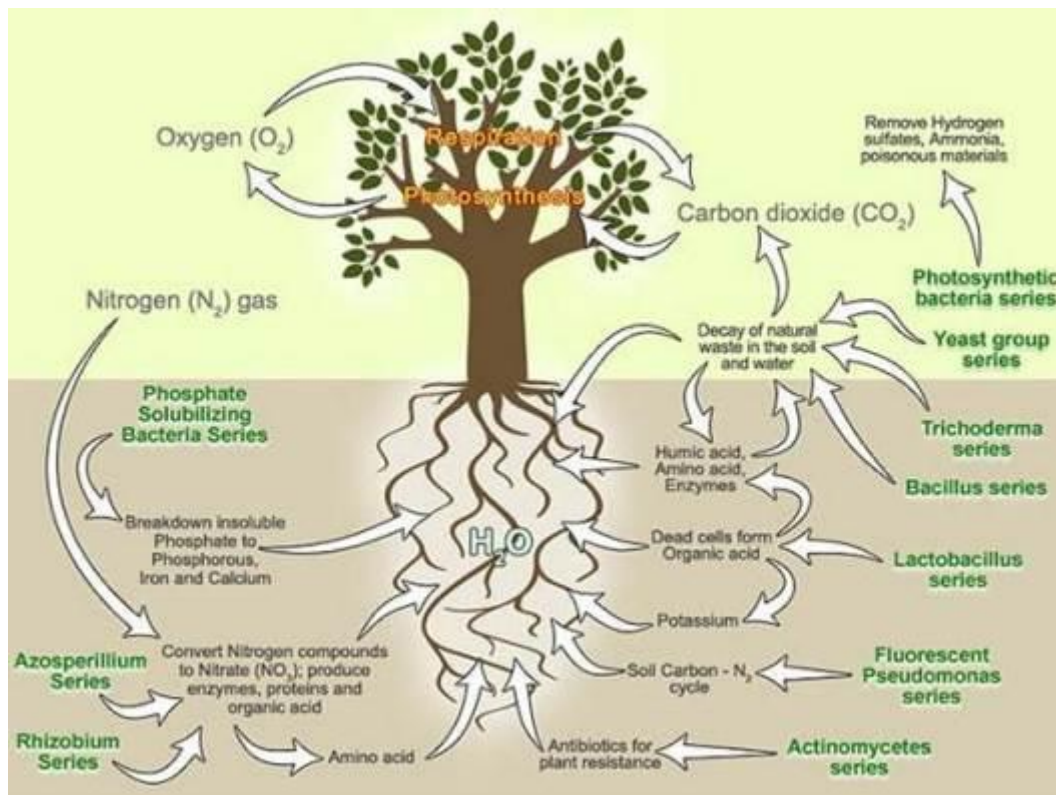
- a) **Lactic acid bacteria**
- b) **Photosynthetic bacteria and**
- c) **Actinomycetes and mycorrhizal fungi**

There are many other microorganisms that are also intimately involved in this process. They go beyond the decaying and recycling actions that we know about in composting and other soil amendment processes. Most of the microbes involved in this technology could be described as **BIOFERTILIZERS** because they produce nutrients.



Many beneficial indigenous micro-organisms (IMOs) could also be mobilized in this process. Here are a few of them.

- 1) Rhizobia and Frankia (for Nitrogen fixing) in symbiotic relationship with plants
- 2) Azotobacters and Azospirillum (for Nitrogen)
- 3) Phosphate-solubilizing bacteria and Fungi (for Phosphorus)
- 4) Mycorrhizal Fungi (for Phosphorus, copper, zinc, molybdenum and nitrogen)
- 5) Plant growth promoting rhizobacteria (PGPR)



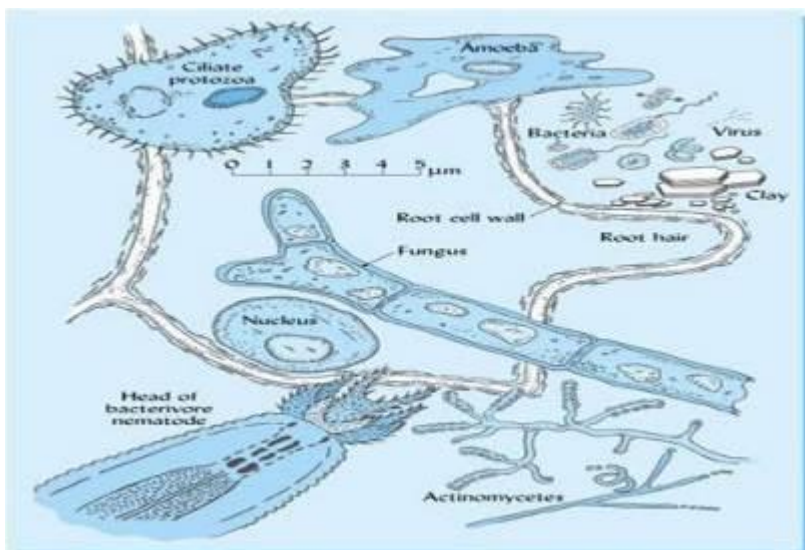
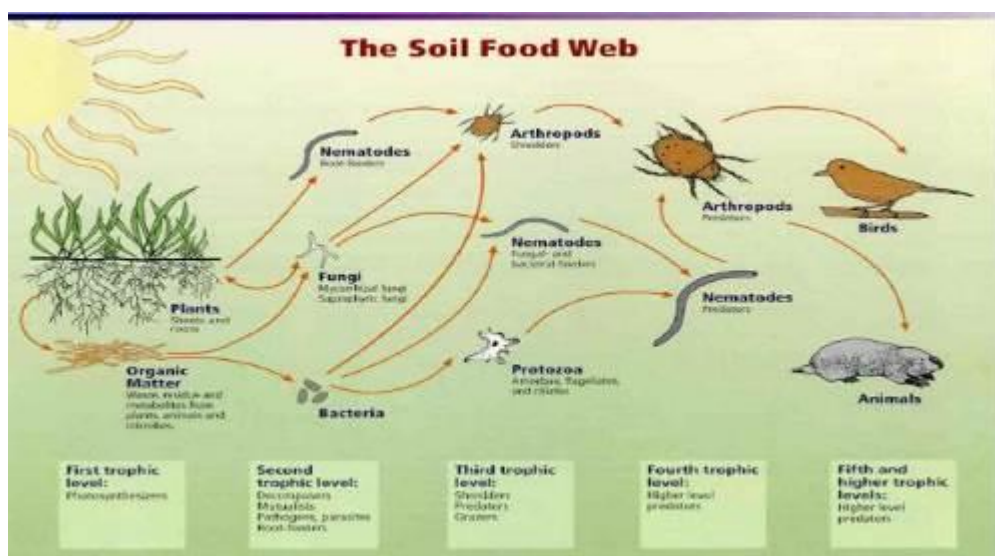
By deploying beneficial effective microorganisms and super soil technologies in our agricultural systems, we can increase the availability of plant nutrients, including micro-nutrients and enabling environmental conditions (physical, biological and chemical conditions) such as magnetic wave resonances. The presence of effective microbes (like nitrogen- fixing bacteria, phosphate-solubilizing bacteria and fungi and mycorrhizal fungi, etc.) in favorable environments promotes plant health and productivity. In other words, these microorganisms can positively impact and contribute to the factors that influence the presence and availability of nutrients in the soil. These factors include chemical, biological, environmental considerations that together, create a complex matrix that is not negligible. This will result in the production of crops that surpass the yields of conventional methods and transcend current limitations.

Why use super soil?

Once again, it must be noted that the soil is the key player in natural and sustainable agriculture. Super soils feed the soil food web that builds the soil structures and create other favorable conditions for optimal production. Synthetic fertilizers do not build the structures or create the appropriate

biological and environmental conditions for optimal production. On the contrary, they tend to disrupt the beneficial environmental, chemical, and biological, matrix that favors sustainable and efficient production.

Once the soil food web organisms are dislodged, either directly or indirectly, the soil loses the structure these organisms create. **Soil structures are important in agriculture.** Losing it makes conditions become increasingly anaerobic. Plants have hard time taking up nutrients in such conditions.



THE LEVEL OF AGRICULTURAL PRODUCTIVITY AT SONGHAI

COMMODITIES	PRODUCTIVITY IN THE REGION	SONGHAI PRODUCTIVITY	ILLUSTRATIONS
Cereals /cash crops			
Maize	< 0.5 to 1 ton/ha/year	3 to 9 tons/ha/year	
Sweet corn	No information	12 to 15 tons /ha /4 times/year	
Sorghum	< 0.6 to 0.8 ton/ha/year	1 to 2 tons/ha/3 times/year	
Soya bean	< 0.5 to 1 ton/ha/year	2 to 2.5 tons/ha/2 times/year	
Rice	<0.3 to 0.8 ton/ha/year	5 to 7 tons/ha/2 times/year	
Roots /tubers			
Cassava	3 to 15 tons/ha/year	50 to 65 tons/ha/year	
Yam	3 to 10 tons/ha/year	30 to 35 tons/ha/year	
Vegetables /Market garden			
Tomato	<8 to 10 tons/ha/year	35 to 50 tons/ha/2 times/year	

Pepper	<3 to 5 tons/ha/year	10 to 12 tons/ha/2 times/year	
Cucumber	<4 to 6 tons/ha/2 times/year	25 to 40 tons/ha/3times/year	
Cabbage	<10 to 15 tons/ha /year	40 to 55 tons/ha/2 times/year	
Melon	<4 to 7 tons/ha/year	12 to 15 tons/ha/3 times/year	
Water melon	<15 to 20 tons/ha/year	30 to 40 tons/ha/3 times/year	
Lettuce	<5 to 10 tons/ha/year	45 to 60 tons/ha/3 times/year	
Okra	<6 to 10 tons/ha/2 times/year	25 to 30 tons/ha/3 times/year	
Carrot	<10 to 25 tons/ha/2 times/year	40 to 50 tons/ha/3 times/year	
Fish			
Tilapia	<2.5 Kg/m3/year	5 kg/m3/year	
Catfish	<10kg/m3/year	16 /m3/year	
Carp	No information	3 kg/m3/year	
Citrus plant			
Orange tree	5 to 15 tons/ha/year	20 to 30 tons/ha/year	
Pineapple	25 to 35 tons/ha/1 year and half	50 to 60 tons/ha/ 1 year and half	

Plantain /banana	10 to 15 tons/ha/year	20 to 40 tons/ha/year	
------------------	-----------------------	-----------------------	---

PRIMARY SECTOR



MAIZE SEED



PRODUCTION OF MAIZE - 9 Tons / ha - 3 times / year





PRODUCTION OF FRESH SWEET CORN - 15 Tons / ha - 4 times / year





RICE INTENSIFICATION SYSTEM - 7 Tons / ha - 3 times / year





CASSAVA - 60 Tons / ha - 1 Time / year



YAM - 35 Tons / ha - 1 time / year



SORGHUM - 2 Tons / ha - 3 times / year





SOY BEAN - 2,5 Tons / ha – 2 times / year





BANANA



PAWPAW - 100 Tons / ha





PINEAPPLE - 60 Tons / ha







TOMATO - 50 Tons / ha - 2 times / year





LETTUCE



CUCUMBER 40 Tons / ha - 3 times/ year



CABBAGE - 50 Tons / ha - 3 times / year



HOT PEPPER 12 Tons / ha - 2 times / year





CATTLE





**POLYVALENT POULTRY -
EGG / MEAT PRODUCTION**





GEESE



PIGS



GUINEA FOWLS



TURKEYS



QUAILS



FINGERLINGS



SONGHAI TILAPIA : 800 g in 6 months



SONGHAI TILAPIA



CARP – 500-800 g in 6 months



CATFISH – up to 25 Kg



SECONDARY PRODUCTION



PREFILLING & FILLING LINES FOR WATER, JUICE, SOY MILK & OIL



DRIED MANGO



GARI



MANGO PUREE



TOMATO PUREE



BAKERY – SNACK/SHIPS



MEAT PROCESSING





AGRIC MACHINES PRODUCTION



SONGHAI EXPORTING
AGRIC MACHINES



GRATER FOR
CASSAVA
PROCESSING

RICE TRESHER



RICE MILL

TERTIARY PRODUCTION



MARKETING & SERVICES



HUMAN SETTLEMENT & ECO TOURISM

