

Towards a Theory of African Science: Methods and Justification

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Abstract: *It is a widely held belief that western Science is a metanarrative, there is no scientific story that is untold in it. In this paper, we opposed this exclamation by projecting the existence, theory and justification of African science as a veritable alternative. The justification for this project we summarized in three stellar points: that we construct a safer science able to solve African problems and other nagging world problems, that Africa may enter history and contribute to world civilization, and that Africans would excel if they learned to reason within their native thought system.*

I. Introduction

With skepticism we notice that empiricism is not clear enough and rationalism is not deep enough, but with both, we discover that skepticism is not strong enough. If one can argue that a piece of knowledge is more empirical then he cannot argue that it is more rational. If he can argue that it is more rational then it is not the case that he can at the same time argue that it is more empirical. Thus with this dilemma, skepticism becomes weakened. Based on this, the attempt of African scientific experience is to increase the horizon of our knowledge and decrease the landscape of our doubt. Western scientists are generally shy of admitting the metaphysical in their explanations because the classical two-valued logic of the western thought system as a tool is incapable of interpreting such extended framework. However, the fact remains that the metaphysical is part of reality as much as the physical. The field forces and quantum mechanics are just good examples on one hand and on the other hand the preference of Einsteinian relativity driven physics to the absolutist Newtonian physics is a shrewd albeit an abashed acceptance that reality transcends the physical. The modest western opinion is that these things are not yet explainable which is a polite way of saying, we have dabbled into the metaphysical and our logic cannot interpret or axiomatize our hypothesis and theories any longer. This makes people like Arthur Clarke to suggest that “any sufficiently advanced technology is indistinguishable from magic”. This is however false! The problem is due to the limitation of western classical logic which is absolutistic. J.M. Bochenski commenting on the relativity of logical systems states, “All this might be thought pure speculation on the part of logician, of no importance for the day-to-day business of science. But that is not the case. In 1944 Reichenbach showed that quantum mechanics cannot be axiomatized without contradiction on the basis of “classical” logic (such as that of *Principia Mathematica*) but that it can be axiomatized straight-forwardly without contradiction in the framework of Lukasiewicz’s three-valued logic (78)”.

In African conception, reality consists of the physical, the non-physical as well as the union of the two. While the first two are partial forms of existence, the third is full. The three-valued trait in African thought system derives from this metaphysics and from it we obtain African logic which is three-valued in character. Chris Ijomah in his theory of African logic tagged “harmonious monism” used it to explain healing in African science. One is healthy if there is equilibrium of his physical and non-physical aspects, and he is ill if there is disequilibrium. He is mentally retarded if the non-physical aspect dominates. If on the other hand the physical aspect dominates, such a person is useless and merely has a vegetative existence. The incantations of an African healer are therefore aimed at restoring the equilibrium of matter and spirit in the person. Andrew Uduigwomen and Chris Akpan on one hand and Kyrian Ojong on another, variously in their different works employed African logic to explain some healing processes of African orthopedics. One of such processes in healing bone dislocation or breakage would be to get a cock or a hen depending on the gender of the patient and cause similar bone injury to the chicken. As the healer massages the chicken and performs incantations, the human patient would be receiving the healing effect. In western science this would be a typical example of a no-contact force. This is however not the case in African science. There is contact! African metaphysics holds that all realities exist in a network of interconnection. What the healer does through incantations is called ontological transfer. In order to ameliorate the pains on the human patient, his non-physical aspect would be transferred to the chicken. This is accounted for in African science using the law of *egwu-eji* (see chapter nine). A western scientist would administer anesthetics which has some nasty side-effects. Humans have been known to die from such. For this, we say that African science not only thrives on simplicity but is a much safer practice. In massaging the chicken’s joint, the physical injury is soothed, while the incantation brings back the exited spirit and attempts to restore the disequilibrium. Anyanwu and Ruch state that what African philosophy is supposed to do is to explain the principles behind our basic assumptions and thoughts. In much the same way, African logic explains the basic assumptions of African scientific practice.

In the past, there has been a debate concerning the existence of African philosophy. Currently, there is an ongoing debate on the possibility of African logic. It seems therefore, that any new organization of peculiar African or alternative brand of a given field of knowledge would follow a rigorous process of debate. Such previous endeavors it appeared amounted to letting some other cocks crow besides one. These transgressed the boundaries of reason and the custom of the salient community. For how can we have another philosophy and yet another logic besides the Western philosophy and logic? What would they be called? What would they be like? What would become of the traditional pedigree of the Western philosophy and logic? Indeed, what would become of us all who study, practice and follow these fields? Interestingly, the supposed apparent dilemma, when unraveled becomes a mere question of *audacity* which degenerates on confrontation to that of merit and then to criteria or standard. In an animal kingdom where only one cock crows, the reaction which trails the sound of another cock crow is not simply that of anger but that of shock and disbelief. The question from the onset is not on whose authority it crows but how dare the cock make a crow like sound? It is not that it has no permission to crow but that it cannot crow and must not attempt to. Even if the crow like sound is actually a crow, it is nothing but a crow like sound.

It is when the question of audacity is confronted with an accusation, properly so, that of prejudice that it quickly melts into concerns of merit and criteria. Before then, it does not matter if the only cock that crows gets worn out and falls short in its duty on all the hens. It does not matter that many hens are left unattended to; it does not matter that others are not properly attended to. The custom and what the salient community is used to is that only one cock crows! But when audacity is forced to make way, concerns would speedily tilt towards merit and criteria. The community which opposed the existence of African philosophy; the one that opposes that of African logic as of the one that would oppose the existence of African science constructed and constructs their arguments on the foundations of merit and criteria. Do such systems of African science have the merit to be called science? Does the so-called African science meet the criteria of the scientific community? In other words, does it meet the standard of modern (Western) science? If not, and which is most likely, they (the opponents) would be quick to award it a consolation tag of mythical knowledge or which is worse, magic.

It does not matter to them that the glittering Western science sprung from the traditions and thought system of the Western peoples and that in much the same pattern, African science springs from the traditions of African peoples. It is unlikely that they do not understand that the standard or criteria of Western (modern) science need not be the same with that of African science. It is plainly and more strongly the case of one cock that crows not willing to accept that another can crow.

However, since after the tension generated from the debate concerning the existence of African philosophy plummeted, a new consciousness has arisen within the African intellectual community. This new consciousness is the cessation of worries concerning Western acceptance of the African position. It does not matter any longer to the lieutenants of African position whether the opponents accept or see their logic, as many as the cocks that could crow, let them crow. It is not acceptance that makes a body of knowledge philosophy, logic or science; it is what works for a given people. The Igbo aphorism has it:

“Nku di n’mba na eghelu ha ite”. “The firewood found in any nation is what cooks for the natives”. This means that the solutions to a people’s problems are usually found within their environment. This environment spans from tradition, religion to customary framework. Since scientific knowledge is in part a response to environmental challenges; environment to a large extent determines the structure of science. Thus, African environment like its Western counterpart technically, will engender a different science from the point of their ontological and fundamental differences. The common indices however, will be that they each squares in well with the challenges of their peculiar environments.

This does not of course, stifle the fact that what works in the west may well work in Africa too and vice versa. Nor do we in this argument denigrate the possibility of African science bringing succor to the Western peoples where Western science proves less effective and vice versa. Indeed, such lacuna as noticed here and there should not draw a line between which is superior and inferior; effective and ineffective but should be the joy of our living (Asouzu 44).

Therefore, the goal of this work is not to promote one science and run down the other but to systematize and structure the African science. It is not to be disputed that the foremost challenge to doing African science at a professional level is the absence of known structure. Those who claim to practice it are scientists, priests, prophets, hypnotists, mystics and sages all at the same time. It thus, becomes difficult to separate African science from superstition or to weld the two together.

This work is a modest attempt to systematize African science and raise a standard or criteria so as to separate the scientific elements from the unscientific ones, outline its methods and processes so that its theories and laws could be discovered and mapped out. This research becomes chiefly relevant to the demands of our times when environmental and climatic problems posed by Western science and further insights reveal the need to tap into the wealth of scientific discoveries of ancient Africans and build on it to complement the efforts of Western science in all spheres of human life.

II. What is African Science?

Many African scholars have attempted what I shall call rough description of African science; some were inadvertently led into errors because they wished to do away with metaphysics. Ozumba (2000: 20) leads this pack, he defines African science as the “African man’s way of observing, systematizing, testing, confirming facts of his environment, with the aim of achieving a high level of understanding of his environment to aid him in controlling or manipulating the forces of nature to his advantage or at least to escape the heavy consequences of uncertainties which characterize natural phenomena”. The point to note here is the reference to both facts and forces outside of which it would be wrong to say that Ozumba’s definition captures the very essence of African science which makes it different from western science. In reaction to Ozumba, Uduigwomen and Akpan asks “if this is (the definition of African science) then what makes it different from western science since this is exactly what the western scientists also do?” (302). This criticism is tenable because some western trained African scholars usually fall into the error of supposing that whatever that must qualify as science must take a full empiricist dive. This leads them into unsuccessful and unhelpful attempts at weaning African science of its embedded metaphysics. Even Uduigwomen and Akpan still fell into such mistake in their definition of what they call modern African science by excluding metaphysics although in the body of their work they showed that it is a necessary part of African science. They define it as such activities aimed at understanding, explaining and exploiting nature for African man’s use (303). Except for grammatical reconstructions, their definition is in every way identical with the one offered by Ozumba which they criticized. Asouzu (3) observes that the reason those who work on the project of systematizing African science try to strike off the metaphysical is because African scientific experience in its original form is couched in, or anchored on the mythico-religious method: a method evaluated as the reason for the stagnation and lack of progress of African science.

But one may ask, are there no such supernaturalisms in the history of western science? Sandra Harding for example describes modern (western) science as ethno-science, suggesting it is the local knowledge system of the west but imposed on other cultures (45). Supporting this view Alozie who classified African science into functional, structural and historical (6-19) maintains that science however it is practiced is a cultural phenomenon (3-6). This means that the African scholar who wishes to systematize African science to institute it as a field of progressive research should not shy away from affirming the metaphysical as an integral part of African scientific experience. What we call science therefore should be that which describes what makes up reality in African world view. And since the metaphysical for the African is no less an aspect of reality as the physical, our science even when systematized must not turn a blind eye to it. In away, describing and explaining the metaphysical is the main distinguishing factor of African science. A science which does not include the metaphysical in its map of reality is surely not the African science.

From the foregoing, a question may be asked: what is western science and what is African science? If we define western science as a body of organized knowledge whose pursuit is tied to the principle of empirical, testable and demonstrable protocol then we may have to define African science as a body of organized knowledge concerned with enquiries into all shades of reality in African world view supported with rational explanations. The difference is that in the former, scientific enterprise is restricted to a segment of reality namely, the empirical, while in the latter, there is no such restriction. All sides of reality are covered provided the methods of enquiry offer explanations and results that are rationally tenable. Rationality is here employed to depict explanations that range from verifiability (in positivist understanding of the term) to coherency (in African logic sense of the term). Based on these explications, as we attempt to construct a theory of African science, we here offer justifications for our study.

III. Methods of African Science

Uduigwomen and Akpan in their work “The Method of African Science” identify four methods of what they call traditional African science. These are the mythico-religious method which among other things operates through superstitions and dogmatic assumptions; the trial and error method which is based on safe guess work and perhaps rationally baseless but faith driven assumptions; the method of causality which operates by tracing the causal links of phenomena not in terms of uniform occurrences but in terms of agency interference or what Gyekye calls “agentive causation” (28); and the combined methods of the empirical and religio-mythical which operates through established practical techniques and inspiration from the metaphysical dimension. In as much as I do not dispute these claims, I do not see how their work has attempted a systematization of African science or any of its aspects if they made little effort at taking it to another level. For the most part, their work simply described ancient African scientific experience. In this work, we go beyond description in a bid to systematize, which also means upgrading what was practiced in the past.

Unlike Western science which captures nature and employs different means to force scientific knowledge out of her, African science approaches nature with equanimity, like a man approaching a maiden he wishes to marry, curious but gentle. This is because the scientist is not different from nature neither are his instruments. A man stitching own wound is likely to be gentle. This gentility in conducting scientific enquiries crystallizes in the observance of *Iwu-nnyiri-onwe* (the law of uniformity). This law ensures that as far as

experiments could be taken that there is a thin membrane which must not be crossed. This thin line is called in African science *udo-ntupo* (UDN) or the dotted single helix. This helix contains the code of an organism's uniformity information. Some organisms UDN are said to be charged and written thus UDN¹ if they are law of uniformity compliant on the other hand, if an organism's UDN is uncharged it is written as UDN⁰ meaning that such an organism is neutral and can be used in all cross-species experiments. Among organisms whose UDN are charged, those that do not match are said to be incompatible. It is the latter group that represents the thin membrane otherwise called the sacred line which experimentation cannot cross without environmental and humanitarian crisis.

In the African societies of the Stone Age civilization, designing some weird idea or even developing same were not regarded as professions, they were more of hobbies. Unlike in the present time, no one in those days hoped to feed his household by some technological or scientific endeavors. In fact, science and technology or *ikwa-nka n' ikpu-uzu* were nobly regarded as attitudes of moonlight play carried to adulthood. Yet when I survey the history of that moonlight play across the passage of time to the present, I couldn't but call it science and technology. To this conviction could be added some silver linings which I shall presently describe as the methods of this science. However, following a systematization of this science, researchers are expected to admit some technological advances in Western science which means some of these methods might not remain the same.

i. Ako-nwalee (Trial n'error)

It was, and to a very large extent still is a veritable method which Africans employ in the pursuit of scientific knowledge. "The *niile nwere mbido*", "everything has a beginning" to an African, any difficult task begins with a play and scientific enquiry is not an exception. Play was and is still a way of discovery. "Ile oma ka eju ji aga n' ogwu", "joviality is the way the snail navigates the thorns". Most times when an *okwa-nka* (the scientist) designs a project or articulates his hypothesis, he like a fowl scratching the earth in a disorganized form for some ant colony, goes about without prior knowledge and sometimes even without experience looking for how to developed the technology. It was basically a trial and error method. The scientist keeps working on his project, though he fails every now and then, there are always fresh ideas. When you do not know the way to your destination, there are always many paths to choose from. He was both the scientist and the technologist little wonder *nka n' uzu* (science and technology) are usually pronounced as one word. Every theorist has to build his theory or at least attempt to, but if he delayed to initiate the action, he was soon regarded as a clown making empty claims.

Let us take *Ikwa Ogwe* (bridge building) to demonstrate trial n' error as a method of African science. Marvelous story of the challenge surmounted in designing and building a bridge across *Idemili River* many centuries ago resonates well in this context. *Idemili* is a fast moving, dark-brown gulf of about thirty yards in width at the point where the bridge was built. It runs from the east and empties in the *Niger River* in the west. A new and big regional market which boasted of exotic goods and large customer base had been opened at *Onitsha* by the bank of the *Niger River*. *Idemili River* was a barrier to all the peoples on the south. Men always swam across, even women too but because of the new market needs they had to swim across this gulf with heavy goods. This was a difficult task even for the swift swimmers and the very strong. Goods were lost each market day and lives were always under threat. Necessity which is the mother of all inventions was calling. No one had ever built a bridge before nor was there anyone who had seen or heard about one in the neighboring countries, but these *Igbos* were soon thinking of one. A design soon came up, it would require two timber logs each between forty and forty-five yards in length and about half a yard in diameter. Smaller logs were to be crossed between these two to form the pedestal path. It soon became obvious that the design had some errors. The areas around the river were swamps and had no tall trees but even if there were tall trees, who could move trees of that size? The design was modified; the two big logs would be replaced with two sleek ones but of the same length. However, the only type of tree that matched the description in the design which could be found in the whole region rots. So again the design had to be further modified. There would be two timbers buried in the middle of the river beneath the bed and four others of about twenty yards each crossed and suspended on top of the pillars, two from the north and two from the south. Cutting and moving the two pillars to the construction site took months to accomplish but turned out to be the simplest part of the task. Initial attempts to mount the pillars were disastrous. Fatal injuries followed by the gulf snatching the logs away greeted the efforts of many months. But that was yet another way which could not work.

The lost logs were replaced and an idea for some wooden crane was under development. It took months to get these tasks accomplished together with the accurate mathematical calculation for the implantation of the pillars. Through a lot of trial n' error these tasks were eventually accomplished and finally, the bridge was ready for commissioning. People thronged the site from far and near countries to behold the new wonder. But then one day, not more than a month into its life span, my ancestors woke up in the morning after a night of heavy down pour to see the labor of more than two seasons washed away. But that was yet another way which could not work.

My ancestors again mobilized down to site only this time they had learned enough to design a plan that would work ... that must work. The new design scraped the wooden logs. A high embankment would be formed at both sides of the river so that bridge would be yards above the river. Also, it would be built with ropes and sticks making it much simpler and lighter than the initial design it was called *ukpa* a kind of container for carrying goods, "because it would be built with the same materials. The raffia which would supply the raw materials was in abundance in the area. Because the bridge would tremble, it was also designed to have arms at both left and right sides so that people wouldn't tumble over. In the end the new design took ten times less work and ten times less time to be accomplished and more durable, save for seasonal repairs. So by trial and error my ancestors designed and built the first bridge known in the region.

However, this method was also commonly used in the early days of Western science. What is shown is that African science is still at its nascent stage many centuries after. This follows from the invasion of the west and subsequent imposition of her civilization. But this systematization aims at not only to resurrect this once abandoned science but to bring it up to speed by augmentation from Western advanced technologies which do not contravene the codes of its practices.

ii. Ako-iju-ase (Interscience)

Akoijuase is a veritable method of scientific enquiry in African science. African scientists recognize that nature is made up of two aspects, Ala-mmadu (the natural) and Ala-mmuo (the subnatural) worlds. Ala-mmadu contains ufele (matter) the positive force and Aru (antimatter) the negative force. While Ala-mmuo contains akara mmuo (thought) the neutral force. It is neutral because it has commanding effect on the two parts of the natural world. It is also called the abode of Ikenga (vital force) where the latter is the instrument of akara mmuo (thought) because it is the sole determinant of motion while matter and antimatter are abodes of ijele (life-forces) which are dormant if not acted upon by Ikenga (vital force). Life forces are further divided into ike (active) Apia (passive) and Idedu (inactive) forces as the characters of beings in the worlds of ufele (matter) and aru (antimatter).

Ikenga is the producer of Ije (motion) without which every being in Ala stands still. Ije (motion) therefore signifies production and part of what is being produced is mmuta (knowledge). Every being yields mmuta as it unfolds and this process of unfolding is Ije. But the type of Ije (motion) which leads to nka-mmuta (scientific knowledge) is called Ije-kpim (elliptical motion) different from Ije-waa (linear motion) and Ije-agwo (zigzag motion).

Now Akoijuase is a method of scientific enquiry in which the okwa-nka (scientist) establishes a link with (non-matter), the world of akara mmuo (thought, whose instrument is Ikenga (vital force)) during this process an interaction takes place between Akarammuo (thought) and Akaraobi (human mind). Akarammuo deploys ikenga (vital force) to illuminate Akaraobi (mind) by simulating Ije-kpim (elliptical motion) among the chosen objects of scientific enquiry in the human mind. So it is like the okwa-nka is watching a demo video of his intended research.

This method accounted for tremendous advances especially in medical research. To this day it is still an important method of science in many African societies. A healer is confronted with a new disease the cure of which is not known. He goes into his okwu-mmuo a kind of laboratory containing accessories which enable him to establish link with Akarammuo (thought). The interaction takes long, sometimes days of continuous trial like the Western scientist sweating away in his own lab, conducting one failed experiment after another. But in the end, when eventually he succeeds, he testifies of having been led around the forest and shown herbs, barks and roots and a demonstration of how they could be used to cure the ailment. Now that he has found Omenala (theory) for his Achoba (hypothesis), it was time to reduce his omenala from principle to practice. He dashes away from his okwu-mmuo (lab), he may have been there for days, he ignores the calls from his wife, his comfort and wellbeing are immaterial at the moment like a Western scientist sleeping in his lab, forgetting food and bath and home, he too would sacrifice anything to acquire nka-mmuta (scientific knowledge). But unlike the Western scientist confining nature in a rack and forcing knowledge out of her, he engages nature in a mutual interaction through the instrumentality of akara mmuo and is peacefully led to a safe type of knowledge he seeks.

This method of Akoijuase (interscience) is likely going to play increased role in a systematized African science, where compatible Western technologies are going to be adopted and adapted to the structure of African science. Such augmentation would increase the efficiency and efficacy of Akoijuase as a method of scientific enquiry.

iii. Ako-ime-obi (Introsience)

This is a mechanical way of reaching nka-mmuta (scientific knowledge) via the functionality of the mind. In African science, mind is looked upon as a production machine that is capable of delivering finished products for any set of raw materials fed to it. There is almost a surety to the ability of the mind to deliver that researchers do not entertain any fear of mix-up or lump-over for this method. Ako-ime-obi is preferred for its

precision and perspicuity. It is further preferred for its ability to treat each isi-okwu (research problem) as unique and to generate unique Achoba (hypothesis) for every isi-okwu.

As a method, the okwa-nka employs it in articulating his isi-okwu which must be chiseled to the last detail to avoid ambiguities and equivocation. For this, there are a few rules guiding the formulation of isi-okwu. It must not be stated in a hypothetical proposition for then it would include conditions which would welcome ambiguities and equivocations. It does not have to be categorical for then it would be too strict and that would form necessary conditions for too much information. It does not have to start with definite or indefinite article for that would make it excessively specific or excessively general. And it does not have to be stated in any way that would give undue direction to the worker for that would cause undue influence to the mind when generating the hypothesis. Hence, as a rule, isi-okwu is to be formulated in a matter-of-fact type of proposition consisting of two parts; the first part providing information on what is needed and the second part providing information on the use of the first part. A good example can be stated as follows:

Isio-okwu:[first part] production of a mechanical apparatus [second part] for the processing of palm oil.

Now, the above statement does not provide less or more information than is necessary for the mind to work on. It does not supply any details about the colour, capacity, quantity, raw materials, amount of labour, time etc., needed for the apparatus. These details, advocates of this method believe, impair on the mind's modest attempt to generate an accurate achoba for the experimentation proper.

When the mind has formulated a good isi-okwu, it goes on to generate accurate Achoba for it. However, it does not stop there, it continues to be part of the experimentation observing why any part of achoba fails to work and finding ways to generate a back-up. This stage is called modification stage when some parts of achoba is modified to suit the field demands. This continues until achoba is confirmed. If however, complications with the achoba rise beyond what is manageable given the circumstance, the mind would be faced with two choices: to reformulate the isi-okwu or to set aside the achoba and regenerate another. The latter is usually carried out for experimental difficulties are usually due to the specifications in the achoba and hardly with the demands of the isi-okwu. Hence, the mind or akara-obi remains at work until achoba-nka (scientific hypothesis) effectively yields ome-nka (scientific theory).

If however, after an effective ome-nka has emerged for the research problem, a relatively similar scenario emerges whether presumed different or identical to the one settled, this method would require the treatment of the fresh research question as unique from isi-okwu to omenala. Ako-ime-obi is opposed to induction where inductive inference is made from one basic result obtained, a generalization is made across scenarios presumed similar. This is why it treats each research problem as unique. But this is a major point of criticism by opponents of this method. They say it reduces the okwa-nka to a mother and his lab to a kitchen. We know in African societies, mothers are typical housewives who have to enter the kitchen many times in a day.

Let us demonstrate experiment on the isi-okwu we established above using ako-ime-obi as our method. The okwa-nka has two reference points: "build an apparatus", which "can process palm oil from palm fruits". Now let us suppose this okwa-nka has not seen any before, has not even heard of any such apparatus. But via his akara-obi he has developed the idea of one out of an apparent necessity. There is plenty harvest during fruiting season and scarcity thereafter. There is high demand from distant markets where palm trees do not thrive. If one would process the oil and have them stored up in pots, he would make enormous wealth during off-season. Therefore, a veritable way which would leave the processed oil durable for long has to be invented. He has known for long that the red part of the oil is durable but the orange part is not. But the only known method in use by most women produces more of the orange part and only a tiny fraction of the red part. The task now is to invent an apparatus which would produce more of the red part. There are two things that would guide the achoba: the apparatus and the red part of the oil. For the apparatus, he comes up with an idea of a square box, the bottom of which has openings, the top of which has a mechanism for squeezing the mashed content.

Several trials leading to several modifications of achoba (hypothesis) eventually saw his akara-obi (mind) triumph. But the second part became an issue. He had reasoned that since the cooked fruits when crushed and fed to his apparatus produced the orange part of the oil, may be if he crushed the fruits without cooking it would produce the red part. That too did not work. He tried fermenting the fruits before crushing, but it did not work. At this time months have passed since the project commenced. His wife accused him of wasting the entire season's harvest on some childish play thing. He was not to be deterred; he was convinced his invented apparatus was not the problem. He also felt sure his idea was possible and the answer lied somewhere in his akara-obi (mind). He would keep on observing and then reasoning.

Another fruiting season arrived, roasting and eating the palm fruits is always a delicacy. The palm tree that produces sweet fruits is always remarked and used for this purpose. He had spent a whole season reflecting and by the time the fruiting season arrived, his biggest idea was to try the sun, which also did not yield much result. He has almost given up the idea till one evening, sited at his obi (reception palour) and eating some roasted fruits, suddenly he could observe, it was all crisp red oil "the fire he roared. It took him several rounds of experimentation and many months to reach the idea that he could first cook the fruits, crush, and fry before

feeding the mash to his apparatus. It worked and finally, wealth came but trailing behind it was fame. For this singular invention, he was renowned in all the countries far and near. For this achievement, some called him ome-nka (a theorist), others regarded him as okpu-uzu (a technologist) but many thought he was all. Such is a rough picture of scientific enterprise in the distant historical epoch of my ancestors and by extension across the Dark Continent.

In all these processes, there was observation, there was experimentation but the akara-obi (mind) played a major role, such is the kernel of ako-ime-obi (interscience) as a method of enquiry in African science. It is likely therefore following this systematization that when some compatible advanced technologies of the Western science are adopted and adapted, it would become even more effective and efficient method of investigation in African science.

iv. Ako-nyiri-onwe (Semsience)

Ako-nyiri-onwe can in certain measures be contrasted with ako-ime-obi for while it lays emphasis on the utility of akara-mmadu (senses), ako-ime-obi thrives on the power of akara-obi (mind). There are two prescriptions of this method: it states that akara-mmadu (senses) play pivotal role in the acquisition of nka-mmata and also similar research circumstances can be treated as a group and not each as unique. This means that inductive inference is a vital tool of this method. A confirmed result can be expressly generalized across a large group of similar circumstances. If an achoba states that drinking the juice obtained from the *fulifu* herb causes one to purge and taking a little red oil causes the purging to stop: and this is confirmed, then it can be generalized that whenever one takes the juice of the fulifu herb he would start purging and if he takes a pint of red oil, the purging would stop. Until one takes place and the other fails, the achoba would not be modified. Each case would be treated as a member of a group and never as a unique circumstance.

Hence, for the promoters of this method, nka-mmata follows ije-waa (linear motion) as opposed to ije-kpim (elliptical motion) strictly defended by promoters of ako-ime-obi. Ako-nyiri-onwe therefore, sees akara-mmadu (human senses) as measures of certitude. “*iru-uka adighi n’ ihe anya huru*”, “there can be no doubting, what the eyes have seen”. Opponents criticize this method for over-estimating the powers of the senses. There are many things, they contend which the senses perceive but which turn out not to be exactly the way they were perceived. The sun and the stars seem so close suggesting that one could pluck them from the top of a tall tree but Nnokwa people who conducted experimentations on this at least came down with a proof that this age long supposition was not true.

This method also states that there is one to one correlation among realities which resemble one another. In African logic this may be formalized thus:

$$\{ \sim(GB(w) \leftrightarrow GB(y)) \equiv (GB(w) \leftrightarrow GB(y)) \} \uparrow GB(w) \quad \dashv \vdash GB(y)$$

It is not the case that an entity w, is not identical to the entity y, is equivalent to w is identical to y if and only if w implies y. And given an entity w if it resembles the entity y, and if it is a problem, then y is its solution. Thus, w wedged-implies y is equivalent to w is identical to y. in African logic; affirmative propositions are negated when stated while negative ones are affirmed (see Jonathan Chimakonam, *Introducing African Logic and Numeric System*).

In this way therefore, a healer creates a mental image of a given disease and as he roams the bush, he looks out for the herbs, barks and roots that match the image he has. Thus akara-obi plays some roles but akara-mmadu for the promoters of this method is pivotal. Though the images are formed in the mind they are however, lively sensual images. So the mind plays but a feeder role.

In forming his achoba and in subsequent experimental trials, the okwa-nka relies immensely on the images of resemblances, yam must be an energy giving food from the way it looks, plantain must be good for the muscle and the bone, paw paw must be good for the skin, coconut water must be bad for the intellect, alligator pepper and cocoyam must be effective in fighting witches, utu-nkita and utu-mmuo both species of wild fruits must be poisonous to man, bread-fruit and pineapple must be healthy for a pregnant woman, cam wood must be good for the skin, dogoyaro must be medicinal, pumpkin leaf must be nourishing but its root could be poisonous, the sediment of palm wine must be good for a newly married man, the same must be good for a breastfeeding mother etc., thus with his achoba formulated he carries out series of experimental trails. Once his achoba is confirmed, it is generalized across a large group.

Ako-nyiri-onwe would remain a vital research method for the African scientist even after this systematization. Insights from compatible Western technologies can only make it better and more efficient means of obtaining scientific knowledge.

V. Ak □-nso-n’az □ (causal science)

This is a method of scientific enquiring which traces the causal links of phenomena, this time not only in terms of agency interference or push but also in terms of uniform occurrences. Beyond this also, there is a question of direction in the application of this method to scientific enquiry e.g. would it be more useful and result oriented to trace the cause from its effect or the effect from its cause? The mechanistic school favours the

former direction because for them, everything one needs to know about a cause is in its effect but on the other hand, the cause generally does not reveal much about its effect. Thus to gain speed and accuracy it is worth the while to study causes from their effects, one example is when one wishes to understand the biological importance of sexual intercourse, factors as pregnancy, child birth, labour etc., tend to supply this vividly and with more accuracy than studying foreplay, orgasm, ejaculation etc.

However, the Transcendentalist school rejects this submission and equates it to a logical inference from conclusion to premises. For them the source of motion which brings about all causes is in the sub-natural world. To understand the agency, what and the why behind a certain motion one has to look for the cause and not its effect. Effects for them are misleading sometimes since the same effect is capable of having different possible causes it would be misleading to trace causes from their effects. A good example is “the witch cried at night and the baby died in the morning”.

To trace the cause from the effect would lead straight to agency push which is the witch that cried at night. But there are as many causes that could have produced the same effect, for example, (other agency push) the baby might have been taken by her sea parents or clan, or by chi-omumu the goddess of fruitfulness, or by Owu-mmiri the sea goddess, or by other gods whom the earthly parents might have offended, or by other witches who did not cry at night, or by the umu-mmiri the under-water angels. (Uniform occurrences) the baby might as well have died due to fever or other forms of illness or simply through suffocation. For all these, the transcendentalists insist that the method of causal science should accurately proceed from studying the nature of the causes. Once the right cause is identified, it clearly reflects on its effect.

IV. Conclusion: Justification for African Science

The greatest challenge to the project of systematizing African brand of science is weaved into the questions: what is the need? What can African science offer that Western science could not offer better? Answers to these two questions constitute the justification for the project on African science. We respond in three point paragraph:

There is a need to raise a science fit with African native thought system. The present author in his paper “Outline of African Logic for the Development of Thought, Science and Technology in Africa”, argues conclusively that African intellectuals have not excelled in inventive and theorizing exercises because the background logic of Western science is not genial to them and not necessarily as Western scholars contend, that they cannot think. Hence, raising an African brand of science with African logic as its algorithmic model will offer a fair platform for African intellectuals to compete in science and technology with their counterparts in the west.

There is a need also, for an alternative science which will be eco-friendly as Western science now present serious environmental problems. The dangers facing our world and mankind in particular ranging from tsunami, tornadoes, earthquakes, flooding, draught, food shortage, diseases etc., which daily threaten the very fabric of life have out grown the capacity of Western science. Also, different scientific experiments have proven dangerous for our environment and unsafe for life. All these point to the fact that a new science that would be eco-friendly and capable of taming the excesses of nature is required.

There is need for a science that can offer safe and adequate energy to the world. The world is facing a huge energy crisis which in many ways has increased the misery of men. Hunger, poverty, high mortality rate, crimes, diseases and wars are fought for the world’s scarce resources. Some of the modest attempts of Western science have created technologies like nuclear power that now threaten human existence. The Chinobu 1986 nuclear disaster and the Japan march 11, 2011 nuclear disaster are cases in point. This also shows that the world needs an alternative science since Western science has demonstrated rashness and timidity. It is my conviction that the above three points provide adequate justification for the project on African science.

In sum, the project aimed at systematizing African science may still be nascent and nowhere near completion but one thing is clear, it holds great promise in two ways: on one hand it serves as a bold African intellectual contribution to humanity and the world and at the other hand it promises a safe path to future scientific investigations.

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