Review Article

Knowledge Systems, Agricultural Practices/ Farming Systems and the Challenge of Climate Change

Emmanuel Yenshu Vubo

Department of Sociology and Anthropology, Faculty of Social and Management Sciences, University of Buea
Email: socpolub@hotmail.com

Abstract

Differences in knowledge systems (especially the dichotomy between indigenous/traditional, on the one hand, and the scientific/modern, on the other) affect the ways in which farming systems (classified correspondingly in a binary fashion into traditional and modern) adapt to or cope with climate change. The reflections in this paper highlight the complexities that derive from this situation, namely differences in levels of sophistication (the one being less equipped than the other in meeting current challenges) alongside a complete overturn of established certitudes paradoxically and in different ways from both ends. The argument is for the development of a complex epistemic system in which the local knowledge systems and the actions of the local farmer will be taken into consideration in a new scientific paradigm that integrates fluctuations, is based on a short range view as opposed to the long range perspective as well as historicizes and correlates natural with human phenomena at the basis of climate change. In terms of actions, there will have to be a revision of the economic world view that refuses to be sustainable as it is oblivious of the damages that it brings to the environment, local people would have to be educated en masse on the issues at stake with which they are little aware of and initiatives in the agricultural sector integrated in all other initiatives geared at meeting the climate change challenge.

Key words: Knowledge, practices, agriculture, climate change, natural phonomena, anthropogenic activities

Résumé

Des différences dans des modes de connaissances qui sous-tendent des pratiques agricoles (en l'occurrence la dichotomie entre le traditionnel/local, d'un côté, et le modern/scientifique, de l'autre) influent sur la façon dont les systèmes agricoles adaptent ou font face aux changements climatiques. La situation est plus complexe que ne semble suggérer le modelé binaire/dichotomique. Bien qu'il y ait des différences significatives entre les deux modes (surtout en termes de sophistication), les certitudes qui ont marqué chacun sont remises en question, chacun à sa manière. Cet article, qui est essentiellement une réflexion, fait un plaidoyer pour un changement de perspective épistémique dans laquelle les savoirs locaux seront pris en comptent, qui sera une vision scientifique à court terme visant à comprendre variations et fluctuations, historicisant le naturel (le changement climatique) et cherchant à faire une corrélation entre phénomènes naturels, d'un côté, et des phénomènes anthropogènes sur le plan global, d'un côté. Sur le plan de la praxis, une révision du modèle du développement actuel, peu soucieux de ses dégâts sur l'environnement, constitue un impératif comme point de départ d'une action global concertée. En plus, il y nécessité sensibiliser les agriculteurs au niveau local de même qu'il faut intégrer toute action dans le secteur agricole dans l'ensemble des actions dans tous les autres secteurs (concernés surtout industriel).

Mots cles:avoir, pratique, agriculture, changement climatique, phénomène naturels, activités anthropogènes

Introduction

The challenge of climate system has made itself felt through science and policy analysis to the extent that it has become a global concern since we are sharing one interconnected world. As a major disruption in trends, climate change is a challenge not only to scientists at global level; it confronts the practices of farmers and their various farming systems which either adapt to or are simply dependent on the environment. The practices are closely related in themselves to knowledge systems, each knowledge system being closely related to interpretations of the regular patterns of nature. One can observe, in the case of Cameroon, two types of knowledge systems which correspond broadly to two types of agriculture, namely indigenous knowledge systems that inform the traditional farming systems of crop and animal production and the scientific-technological complex system which is at the basis of attempts at modernizing food production. This presentation hopes to examine the challenges that climate change poses to these two systems and how actions within each of them are going to react to these challenges. The argument is that science brings a new awareness to these challenges through its own knowledge system but that awareness seems not to be getting to different farmers in the same way and in the same proportions. This is because gaps in awareness follow the general pattern in lack of visibility of ecological issues that can be observed with local peoples (Yenshu Vubo and Fonchingong 2006:12).

In the present world system, with its hierarchy of levels of operation, a variety of issues escape the understanding of local peoples that are still living in the territorial confines of the pre-colonial societies and only loosely connected to the current of the so-called globalization. This explains [people's] ignorance of the importance of …environmental issues (ibid.: 31).

The modern farms, on their own part, may be slow in catching up because of the gap between scientific production, technological developments and the adoption of technology or even the pressures/ imperative for producing for the Market (business as usual). The key question therefore is that of how different farming systems adapt with the new awareness that science brings before mitigation and adaptation measures or even long-term control measures are put in place.

We will start with a brief description of the farming systems, the challenges of climate change to agriculture and end with reflections on how to meet the challenges. The basic premise is that issues of adaptation and coping with environmental challenges are essentially socio-cultural issues as they involve attitudes, habits, world views and social relations. Our perspective is systemic rather than piecemeal because the socio-cultural world in its relation with the environment is a system and not a collection of disjointed socio-cultural elements, some congruent with others or posing obstacles to others. This is the dimension of sociology that links man to the environment, integrating knowledge and development concerns. This arises from the argument that climate change issues have left the domain of nature proper and become part of history, not the natural history (of fundamental scientists) but human history as part of it or an offshoot of such a history (Maalouf 2009: 277-289).

Farming Systems, Knowledge systems, Farming Practices

It is a truism that agriculture has always been founded on some practical knowledge derived from observation of nature's regular patterns. One can say that of all knowledge systems, agricultural knowledge cannot afford to be less practical and empirical. Unlike myth, legend, folklore or metaphysical speculation, knowledge for agriculture cannot be detached from knwledge about nature. Agriculture is thus the best expression of those human categories that follow the pattern set by nature or are highly informed by the latter to the extent that "a part of social organization results from man's appropriation of the objective constants and regular patterns of the eco-system" (Morin 1994: 361; translation mine). In this regard, differences between knowledge systems are not so much about innate differentia as about degree of relation to nature and just how much nature informs or how much the human societies hope to cope with, interpret or manipulate nature as such. Cultures come to render this relation with nature complex by adding specific human dimensions without eliminating the nature dimension.

As such, indigenous knowledge which is at the basis of our traditional farming systems is based on an empirical understanding of the world and, in terms of climate, the regular patterns and cycles (seasons, rainfall and temperature patterns, soil fertility, crop yield etc). It may be closely related to or mixed with beliefs, social categories of perception (personification of forces or natural objects, collapse of nature-culture divide) but the age-old practices are related to a calculated division of the natural world into various segments with use value (in this case arable land), religious sites and part of nature with no evident significance (Yenshu Vubo 2000: 81). Nature informs local people who may also venerate it or result to religious practices to cope with its overwhelming influences (e.g. rituals to ensure fertility, break the winds, invoke rain or stop it). In the latter regard, the way local man copes with nature and its vagaries or "overwhelming nature" (ibid.) may be embedded in the pre-critical stage of Norbert Elias Grand Evolution of knowledge systems. The latter postulates that:

Les hommes des sociétés préscientifiques sont, dans une bien large mesure que ceux des sociétés qui connaissent la science, livrés aux caprices de la nature, y compris à ceux de leur propre nature. Leur capacité à se protéger des phénomènes naturels indésirables et à se plier à leurs propres besoins est relativement limitée (Elias [1983]1993:82).

It may also be inscribed in systems of practically useful indigenous systems that exploit but also pay a lot of attention to the regeneration of surrounding nature. These are the knowledge and practices underlying a harmonious relationship between Humans and the Biosphere (Latouche 2010: 19). Science, on its part, is also based on observed regularities in natural phenomena and the idea of stable linear occurrences that can be subject to the scientific logic of laws, principles and patterns. Central to this reasoning are the ideas of "reality congruence" (Elias op.cit.:82) and the promise of stable, reliable, valid knowledge. The scientific revolution as one of the constitutive elements of modernity as a rupture with the past brought with it new certitudes: the certitude about a knowable world, the certitude of precision in knowing, knowing to predict and knowing to act. The last aspect corresponds to the applied dimension of science, intervention disciplines and technology which are critical in agronomy or modern agriculture that benefits from advances in science. Here there is relatively greater mastery of nature (Elias op. cit.: 83).

The dichotomy in knowledge systems is reflected in the dichotomy between traditional and modern farming systems. Traditional agriculture (horticulture, subsistence farming characterized by bush fallowing/ shifting cultivation, expansive cattle rearing based on seasonal transhumance, rearing of domestic animals) which is labour intensive, depends on the bounties of nature and the limited empirical knowledge of climatic patterns and natural occurrences. This is the backbone of the country's food production, the economy of food production and the peasant cash crop economy which provide the bulk of rural incomes. This sector has undergone some limited changes over time beginning in the colonial period and through the post-colonial period into the present context of globalization but it still stagnates because improvements have been piecemeal (Yenshu Vubo 1991:159; 212). This sector is precarious and is likely to become the greatest victim in the wake of climate change as it has been itself vulnerable to the vagaries of the climate over the years even prior to the preoccupation with global climate change (prolonged drought, desertification, torrential rains that lead to flooding, etc.). Conversely, this sector is said to hold great potentials in terms of environmental sustainability and low degree of contribution to climate change . This has been observed within the domain of indigenous/traditional knowledge systems and more specifically with pastoralists:

Traditional knowledge has managed to conserve natural resources in a sustainable way in many countries around the world. Much agricultural production is sustainable, and in some cases large areas have been under continuous cultivation for many years (World Bank 2007 in Paul et al. 2009: 40).

Mobile pastoralists are among those most at risk to climate change, yet they are amongst those with the greatest potential to adapt to climate change, and they may also offer one of the greatest hopes for mitigating climate change (Davies and Nori 2008: 127-141).

Modern agriculture is also informed by nature but to a greater degree and in more complex ways making an allowance for greater adaptive responses and interventions through a technological push. The science-technology complex has accelerated the capacity to be less reliant on habitual empirical knowledge. Man can now confront some of the seemingly overwhelming difficulties that nature presented by providing clues on how to overcome them, modifying the course of nature, consciously or unconsciously, uncontrollably (as with the anthropogenic activities that have resulted in global transformations of the climate change type) or with an ability to control it . This development was described by Norbert Elias in his conception of the Grand Evolution in knowledge systems in the following terms:

Avec le concours de l'accroissement de la science, l'espace de sécurité que les hommes délimitent pour eux-mêmes à l'intérieur des processus naturels antérieur à l'homme, donc l'espace accessible à leur contrôle, est devenu beaucoup plus grand que jamais. (Elias ibid.: 83).

Even where some aspect is controlled or controllable, some of these changes still escape the modern science-technology complex. This is the current dilemma posed by humanly induced climate change put into motion by the science-technology-capitalist economy complex as contained in the following observation.

Depuis les années 70, nous avons découvert que les déjections, émanations, exhalaison de notre développement technico-industriel urbain dégradent notre biosphère et menacent d'empoisonner irrémédiablement le milieu vivant dont nous faisons partie: la domination effrénée de la nature par la technique conduit l'humanité au suicide (Morin 2002: 5).

As such, the modern agriculture of plantations and ranches that dominates the modern sector and is essentially a cash economy and externally oriented, excels with its immense capacity to master the problems posed by nature as it mobilizes vast resources. On the contrary, it introduces problems with new human settlements, dam-induced changes in farming practices, monoculture and soil depletion, chemical fertilizers running off into streams, rivers and the sea. This agriculture induces substantial changes in vegetation cover with the demand for vast areas of land, soil use patterns and soil composition (as with monoculture), depletion of resources and the destruction of biodiversity. Industrial agriculture is also largely responsible for "more environmental pollution and more climatic change" (Paul et al. op. cit: 28). If agriculture is "the largest producer of non-CO2 emissions" while "GHG emissions arising from agricultural activity are accounted for in other sectors such as manufacture of equipment, fertilizers, and pesticides, plus-on farm use of fuels and the transportation of agricultural products" (Rosegrant 2008: 5), it is in this scale of farming. In this way, this type of agriculture promises bounty but is also the source of unpredictable changes it cannot handle in the short run (soil pollution, poisoning of water courses, loss of biodiversity and modifications in eco-system). Intensive agriculture is also faced with current climatic changes as it is only partially capable of handling the ensuing challenges. It thus joins traditional farming systems in the current predicament as it is confronted with global warming, changes in rainfall patterns and other seasonal climate variations. One needs to add a word of caution here by stating that the substantial difference between the two farming systems is the level of technological sophistication. As such, the capacity to cope with the challenges is unequal.

The Challenge of Climate Change and the Prospects for Agriculture

"Climate change exacerbates existing risks to farmers, such as water stress, diseases and food security" (Paul et al. op. cit.: 36). Climate change disrupts habits and knowledge systems whether these are the age-old empirically useful indigenous knowledge of the local farmers which are complemented with religious rituals, the agriculture of the peasant who has come under the influence of modernization (as in the case of elite rural farmer) or the industrial farmer. All of them have relatively little control over the new vagaries provoked by climate change: "increased temperatures, changes in rainfall patterns, more droughts, floods and recurrent extreme weather conditions" (ibid.: 37). El Niño effect, tsunamis, yearly tropical tornadoes are also some of the visible indicators of what these changes are likely to produce. Even the very notion of natural catastrophes that defy prediction is a challenge to this view of science. These developments are first of all a challenge to the stability that was based on certitudes about nature that could be predicted. Climate change is a challenge to both certitudes derived from two worlds, one traditional, the other scientific. This situation is described by Morin in the following words:

Les civilisations traditionnelles vivaient dans la certitude d'un temps cyclique dont il fallait assurer le bon fonctionnement … La civilisation moderne a vécu dans la certitude du progrès historique (Morin 2002:1).

In the domain of science which tries to inform the world of the changes, climate change is likely to challenge the long-range view of science or patterns that could be observed and described as permanent (rainfall patterns, climatic zones, regular seasons, rainfall patterns, sea levels, etc.). The scientific vision replaced other forms on grounds of operational efficacy and predictive value. It is informing currently but some of the climate changes are either in the short range (therefore unpredictable) or chaotic and may lead to stability. That may be why the call is to limit the effects of anthropogenic activities. This mutation consequent on anthropogenic activities poses problems for the understanding of eco-systems and actions within them which the long range view of science will consequently be little adapted to cope with. It is part of several disorders that have coincided with the transition from the 20th to the 21st Century (Maalouf op. cit.; Corm 1993). Its very anthropogenic nature makes of it a historic event, that is, an event within time and space as human perception of occurrences.

We cannot say whether it is acceptable or even possible to anticipate a new world climatic order where the older cycles would have been altered totally through a continuation in present trends. Can we start envisaging a situation where truly "anthropogenic activities have begun to change the climate in ways that may warrant a significant modification to existing agricultural knowledge and practices"? (Rosegrant op. cit.: 17). The unspoken consensus is towards mitigation by either reducing the risk of exacerbating the current trends or adapting to the changes without either a return to the world as it has always been and as known to both the local man and the scientist, or accepting a world that has been transformed totally by climate change.

The question that confronts us is that of how the different systems meet or could meet the challenges posed by these developments. One sure answer is that there are differences in coping and levels of adequacy. These disparities are even too wide. While the scientific world is waking up to the challenges by observing the new developments (and not definitely any new patterns, laws, principles or linearity), the local peoples are either waiting for the regular climatic patterns to recur in cycle (as usual) so that the cycles of farming and transhumance can continue. Despite the disruptions in climate cycles, farmers still rush to plant in mid-February (as observed in 2013) or by March 15 when some little rains have been observed only to discover that the real rains are around only by late April or only May. Adaptations are slow and follow general patterns of awareness of environmental concerns. Local people have been caught unaware by the unexpected twists of climate change: global warming that intensifies desertification and leads to drastic drops in crop yield in the Sahel, drying up lakes such as Lake Chad that affect fishing, and tornadoes that suddenly trigger floods in areas that have not had rains for long or only scanty ones (as recently occurred in some regions of Cameroon). On the contrary, one will be questioning whether industrial farms are rising to the challenges? A Nigerian study shows that the climate change impacts have been "damaging to net revenue" for plantation agriculture (Fonta, Ichoku and Urama 2011: 69) with some of the adaptation measures being "late planting" and irrigation.

These new vagaries may only be adding to old ones which local people have been used to and for which they have been seeking for adaptive measures. The new ones which are not or little understood even seem to be too global for the local people to come to terms with. In fact the global dimension of climate change is way beyond the local farmers to comprehend and handle. The adaptations proposed by modern science often do not find their way to the local farmer who faces problems related to adoption of innovations as some are sophisticated or expensive . This is the case with industrial livestock intensification involving enclosures that is argued to have the potential of capturing emissions in factory farms and whose "biogas can be used to produce energy" (Paul et al. op. cit.: 28). Small scale traditional cattle rearers often do not have the capital to afford the means to build enclosures and plant improved fodder. This is compounded by the inability to cope with other problems such as cattle plague that may result from poorly managed sedentary animal husbandry or a lingering attachment to traditional knowledge systems (Duault, de Martin de Vivies and Yenshu Vubo 1987). The solution still lies in sustainable extensive grazing, complementary farming and grazing activities among small scale farmers and herdsmen and mixed farming by the same farmers (Duault, de Martin de Vivies and Yenshu Vubo op. cit.: 57) as well as "better regulatory support for mobile systems of grazing, such as pastoralism and transhumance" (Paul et al. op. cit.: 27) as they have been observed to "conserve ecosystems and reduce greenhouse gas emissions" (ibid.). Modern large scale intensive mechanized farming has a strategic advantage in terms of innovation adoption because of its proximity to the science-technology complex. However, the global nature of the crisis of climate change, the imperatives of business and the logic of profit are often at variance with the exigencies generated by climate change.

We may be thinking of abandoning the long-range view of science in favour of a short- range view that will have to develop complex models for understanding the complex of human-natural interactions, the changes, the relationship between the global and the local (a sort of thinking both global and locally). Such as model will be globally systemic inviting scholars and policy makers to some form of complexity which combines order, disorder and organization (Morin 2002: 3). This interconnectedness will envisage a synergy between local (in this case, local knowledge systems) and global (science, international agenda setting, national policies) with implications in terms of knowledge and cultural flows at multiple levels (planetary to local, planetary to regional, planetary to sub-regional and country, etc.).

The final question is that of how different types of farmers are adapting or will adapt with the new awareness that science brings. For now the adaptations are too timid and too slow. It is still largely a global affair which seems to concern mostly the scientists (among who we have agronomists), multilateral organizations, inter-governmental organizations, environmental NGOs and other good-willed persons (who make of it a big business of its own) and local cosmopolites (such as elite farmers in the villages). For now, this looks as an elite affair that has not yet come to local farmers, a global affair but one which is selective and not yet a mass affair. How to go beyond the present elitism and timidity, that is the great challenge. Both types of farmers may not have to wait for the cycles but for the feedback from global summits and global actors. They will not definitely be present at global summits where the future of the climate will be decided. What will this feedback consist of and what will be the impact on local farmers? Are there lessons to be learnt from the diversity of local farming systems and how they have been coping with their environments? These questions will definitely need to be answered and research agendas will have to be adjusted to come to terms with them.

Conclusions

We started with the observation that the predominant division of farming systems into traditional and modern corresponding to contrasting knowledge systems (framed as backward as opposed to advanced) are based on certitudes on regular climatic cycles and patterns that climate change has modified significantly under the push of anthropogenic factors (traced to, although not exclusively to the science-technology-industrial complex in a competitive economy). Adaptations to this new situation as well as mitigation efforts contrast significantly depending on where one stands in the divide with the science-technology pole having more prospects of better understanding through more reliable knowledge and potentially more efficient recipes. Even then, the latter advantage is compromised by the challenge that the current development model poses to the long-range view of science which informs modern agricultural practices. This calls for a reversal of perspectives that adopts a short-range view consistent with the fluctuations and instability observed with climate change. Such a stance will incorporate the point of view of the historical social sciences into an understanding of climate change by linking human activities systematically and in a systemic manner to climate change. For now, it is only piecemeal rather than systemic.

These proposals gain their rationale from the contradictions of the current world system. Mitigation efforts run parallel to and are at the risk of being compromised by a compelling drive to realize ever increasing profits, an untamed and uncontrolled model of development measured in terms of digits of growth with little concern for the environment (with its new champions being the emerging countries and a hesitation by some leading industrial countries) to join global efforts to meet the challenges. In this situation, the instability in climatic conditions is likely to continue for some time in a less linear and less predictable manner. A more pragmatic research agenda with a short-range view, less linear in character, correlating the human (economic cycles, mitigation efforts, adaptation) and the natural (cycles, fluctuations, randomness) in a curvilinear model seems to be more suitable in understanding the issues at stake. This is consistent with developments in the epistemology of the sciences wherein "intrinsic randomness and intrinsic irreversibility (or the arrow of time) are being discovered as the basis of physical order" (Wallerstein 1991: 233). Climate change leads to fluctuations and even random occurrences that modify the objects of the sciences relating to agriculture (plant and animal life, soils, atmosphere, rainfall patterns, etc.). In the same way that "bifurcations introduces history into physics and chemistry" (Prigogyne in Wallerstein ibid.: 234), climate change and its manifestations, taken as "fluctuations" approaching 'bifurcation points" (ibid.), have become historical events (maybe for the first time) that will have to be studied as occurring within the interface between the human and the natural and in an epistemic framework that transcends normal science.

Contributing rather marginally within a certain "programme fort" (ambitious research agenda) (Bourdieu 2001: 41-66) that will be at the basis of this paradigm shift, local farmers will have to be the object of some sort of vast climate change education and mitigation programme. In this way, the former will cease from being passive victims of phenomena they are little aware of or can do nothing about and start becoming actors in their own right. In similar manner, the industrial farmer will have to stop for a while, keep the logic of profit and business-as-usual aside and think with all other actors. Are they not also major losers with climate change? This will only make sense in a significant way if the actions of the scientist, the local farmer and the industrial farmer are associated in a comprehensive manner with those of other actors, especially industrialists whose businesses are big pollutants and which turn the world into unwitting and unwilling victims.

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