Impacts of Competitive Choice Methods on Cocoa Yields in Cameroon

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Abstract

In Cameroon, cocoa is the first export product after oil. It represents about 25% of the total value of the country's exports. It is grown in 7 of Cameroon's 10 regions and covers an area of about 400,000 hectares. It involves about 600,000 producers and nearly 8 million people live directly or indirectly from the cocoa economy. Increasing cocoa production and meeting quality standards are among the goals set by the government to improve this economic growth, in order to raise the low purchasing power of the rural population through a strong and sustainable economy. The basis of this paper was therefore to evaluate the impact of two cultural approaches taken individually or mixed on the agricultural yield in Cameroon in the cocoa sector in the period 2000-2016. The estimation of time-series data from a two-sided system by the ordinary least squares method allowed us to obtain significantly positive results from the impact of different farming approaches on agricultural yield in Cameroon. The different approaches mentioned here reveal a real problem of choice in terms of agricultural policy in Cameroon. Public authorities should opt for a mixed approach for profitable and sustainable cocoa farming.

Keywords

Cultural Approaches, Cocoa Farming, Agricultural Yield, Competitiveness, Cameroon

1. Introduction

The peculiar geography of Cameroon makes it called "Africa in miniature"; the country has an important ecological diversity to find within it all the environmental varieties of the African continent. A study of the operating model of Cameroonian agriculture reveals the existence of diverse farming techniques and agricultural typologies that perfectly match this environmental richness. This

means that Cameroon develops agricultural products that vary according to the climatic regions. This diversity of Cameroon's agriculture gives the agricultural sector enormous economic potential, which makes it a particularly important sector in the promotion of development. In fact, the agricultural sector in Cameroon represents about 60% of the active population, with a contribution of about 30% of the GDP and about 16% of the budget revenues of the country. This sector has always been considered as the main provider of wealth, which is why the speeches of the various Cameroonian political authorities have always been considered as a priority in the country's economy. But the fact is, in general, a relative stagnation of the agricultural performance of the country was noticeable. On the external level, this can be explained by constraints related to the international environment, particularly via the volatility of the prices of export products, whereas internally it depends fundamentally on the policy measures implemented, their coherence, and their phasing, as much as their deadlines. The crises of the mid-1980s and recently the 2008, sparked renewed interest in the predominant role played by the agricultural sector in developing countries [1].

Cameroon has agricultural crops. These are divided between perennial agricultural crops (mainly for export) and food crops for local consumption and, to a lesser extent, for export. In the category of perennial crops, the main products selected according to their economic importance are: cocoa (which will be the subject of this study), coffee (in its two variants arabica and robusta), rubber, banana, cotton, tea; food production is more diversified; Without pretending to be exhaustive, we can mention in this category: groundnuts, plantains, tubers, fruits, maize, potatoes and other tropical products [2].

2. Literature Review

The analysis of the role of agriculture in economic activity is of major interest, because of its contribution to economic growth and the consideration of the influence of internal, external and institutional factors stemming from the in classical literature, the architecture and credibility of institutions are also a major determinant of agent incentives and therefore economic performance. Indeed, the main objectives of agricultural progress are known; increasing yields by increasing the volume of production and increasing productivity (Verrière Jacques, 1997) [3].

Several authors view agricultural development as the best option for addressing underdevelopment problems in developing countries because of its positive impact on the living conditions of the poor (Biswanger *et al.*, 2001, Stringer and Pingali, 2004; Kydd *et al.*, 2002), while others place particular emphasis on the role of the non-farm sector on the well-being of populations (Eswaran *et al.*, 1986) [4]. The first approach is the foundation of this study. Indeed, while most authors seem to agree on the benefits of agricultural development, a cleavage seems to emerge in the inking "quality-quantity" for a better agricultural competitiveness. Two main approaches are opposed to the choice to be made:

- A qualitative approach considered as a source of economic growth.
- A quantitative approach considered as a source of agricultural yield.

The developments of Yves Poisson (2018) perfectly illustrate the theoretical anchoring between qualitative approach and quantitative approach in scientific research. Indeed, many social scientists have been inclined to support and profess that only the quantitative approach could offer enough guarantees to make social science research a serious and reliable research. On the other hand, the qualitative approach is not new in the field of the human sciences, more specifically in ethnology and anthropology. Indeed, more than sixty years ago, Malinowski (1922) was one of the first to make scientific ethnological studies by describing the daily life of peoples living in the Pacific Islands. Participatory observation as well as in-depth maintenance were then privileged instruments for realizing this new type of scientific study on the ground [5].

The new element on which this paper proposes to insist is the fact that research in agriculture whose approach is qualitative has more and more followers and therefore the results are questioning. We can hope that one day, in the academic world and in the organizations charged with subsidizing agricultural research, we will see, placed on an equal footing, all the serious research projects, regardless of whether the methodology used is inspired by a quantitative approach, a qualitative approach or a mixed approach. In order to achieve this objective, we need to abandon, as researchers in agricultural economics, certain prejudices exclusively favorable to the quantitative approach in agricultural research and to open up more to the positive aspects of qualitative approach research. To better understand and make the most of this relaxing movement, it is necessary to understand the various factors that may have contributed to fueling the opposition between the proponents of the two research approaches [6].

Before proceeding with the analysis of the causes of division between researchers who favor the quantitative approach and researchers who favor the qualitative approach, it is important to specify how they differ. Briefly, it can be said that any researcher who adopts the quantitative approach in research gives priority to the interplay of correlations that can be established between the variables under observation. This is the case, for example, of the laboratory psychologist who, using the classical experimental method, with an experimental group and a control group whose subjects have been selected and assigned to one or the other group at random, tries discover or determine whether the experimental group, because of special treatment, outperforms the control group in a statistically significant way. The case of the sociologist conducting a survey from stratified sampling and using questions chosen in advance can also be used to illustrate what quantitative research is. One could also think of the type of research that has often been done by agricultural researchers to determine the correlations that exist between groups of farmers belonging to different social classes defined on a recognized scale and their agricultural performance obtained through validated performance tests. Some elements come back more often in quantitative approach research: use of a large number of subjects, control

of the subjects when assigning them to one or the other group, construction and use of measuring instruments and validated observations, calculations and verifications using appropriate statistical instruments [7].

On the other hand, the partisan researcher of the qualitative approach does not try to quantify the phenomena observed in order to establish correlations. Instead, he tries to grasp reality as the subjects with whom he is in contact live; he tries to understand reality by trying to penetrate inside the observed universe. The first example that comes to mind is that of the ethnologist who, to advance the scientific knowledge of aboriginal family structures, decides to spend two years in these people and live like them. The social worker who wants to obtain valid and scientific information about the living conditions of the unemployed roomers in the city center proceeds in a similar way, spending as much time as possible with these people and questioning them in depth. Open, without using a structured and inflexible questionnaire. The same is true for the agricultural economist who wants to know if producers and consumers are responding positively to a new agricultural program; it is for this agricultural economist to spend hours and hours living with the farmers by observing and noticing, discreetly on the spot or preferably at home, anything that can constitute reliable indicators to describe the reality studied. The few examples that have just been given do not exhaust all the research possibilities offered by one or other of the methodological approaches analyzed; they merely highlight the particular characteristics of the two categories of research [8].

Qualitative research is therefore fundamentally based on the assumption that an internal understanding can be accessed, and this makes possible an understanding of human behavior superior to that provided by a surface study that involves quantitative methods. In addition, the qualitative method allows the researcher to closely glue the data and thereby develop, from the data themselves, explanatory patterns that are more analytical and better articulated on the reality. In qualitative research, the theory often occurs after the observation, from an extrapolation resulting from the events themselves. The researcher does not start with models, theories, hypotheses, but rather a certain understanding of the interactions and everyday facts that will be examined against more general models or treatments. It is usually from an interpretation of the world through the perspective of the observed subjects that the meaning of reality is revealed when using a qualitative approach to research. But it is precisely on these points that there is opposition between the principles of quantitative methods and those of qualitative methods. Many economics researchers consider the quantitative approach insufficient to meet current needs. For them, research in economics should make more use of a methodological approach where there is communication and a deep understanding between the subjects observed and the subjects who observe [9].

An analysis like the one just made can be interpreted, at first glance, as a plea for the qualitative method which, in itself, should be considered as the best way to reach the reality of the social world. that we want to study. In these epistemo-

logical arguments, we must rather see an incentive to stop doubting the seriousness of this approach. "Qualitative" researchers in agricultural economics are only beginning to make a dent in the unanimity often expressed in favor of the superiority of quantitative research methods. All this debate ultimately results only from the choice of the paradigm made by the researchers [10].

One may wonder whether we are in the process of undergoing, in the field of agricultural sciences, what Kuhn (1970) calls a scientific revolution. The way in which research in agricultural economics has been viewed has changed considerably in the last ten years. One fact remains: qualitative research is not close to supplanting quantitative research, but the first is emerging more and more so that the two approaches come together almost regularly. How to explain this change of situation almost spectacular? The answer can come again from Kuhn's (1970) book. Indeed, for Kuhn, any scientific group eventually develops a paradigm of its own and, when this paradigm no longer meets the needs of the group of researchers who use it, it is replaced by a new paradigm. Since the term paradigm has been widely used in scientific circles for a few years, the meaning of this term needs to be clarified here. This is all the more justified because Masterman (1970) has found in Kuhn's work twenty-one different ways of using the word paradigm. According to Kuhn (1970), the term paradigm can be used in two different senses. On the one hand, it represents the whole set of beliefs, recognized values and techniques that are common to members of a given group. On the other hand, it denotes an isolated element of this set: the solutions of concrete enigmas which, used as models or examples, can replace the explicit rules as bases of solution for the riddles that remain in the so-called normal science [11].

It is therefore important to remember that a paradigm is fundamentally a way of seeing the world, a general perspective, a way of breaking down the complex reality of the real universe. As such, paradigms are deeply present in the socialization of paradigm researchers as well as practitioners since they tell them what is important and reasonable to study. Moreover, paradigms are normative; they tell practitioners and researchers what they must do without the need for them to go through long existential or epistemological considerations. However, this aspect of the paradigm is at the same time its strength and its weakness. He is his strength because he makes action possible; it is its weakness because the very reason for the action is hidden in the postulates not put into question in the paradigm [12].

Adherence to a particular paradigm rather than another predisposes the partisan of a paradigm to see the world and the events contained in it in a very different way. The strength and appeal of a paradigm is therefore more than a mere methodological orientation. It is a way of grasping reality and giving it meaning and predictability.

Campbell (1979), well known for his outstanding contribution to the development of the experimental quantitative approach, has recently shown that, as a specialist in research methodology, he must now contribute to the development

of an epistemology applied which incorporates both approaches. It is always difficult to specify with certainty the purpose for which one or the other research approach should be reserved. Some authors will argue, for example, that the qualitative approach to research is better suited to the development of knowledge, whereas quantitative research would be more appropriate to validate and generalize the knowledge acquired through qualitative research. This is the idea that Gage (1978) develops when he writes that beyond relaxation between the qualitative approach and the quantitative approach, we must rather consider a better exploitation of the results obtained by one or the other approach. This thought by Gage suggests that educational researchers would benefit from learning from what other researchers are discovering through a different approach to theirs. For example, the "quantitative" researchers could use as a research track what the "qualitative" have noticed particular and unusual in their studies. "Quantitative" researchers should admit that an ethnologist, linguist or informed observer, noting the emergence of a new phenomenon, provides sufficient evidence to demonstrate that this phenomenon exists [13].

Not everything has been said about the respective merits of the qualitative approach and the quantitative approach for research in agricultural economics. Moreover, it is not certain that the qualitative method should be reserved only for heuristic activities whereas the quantitative approach should only be used to prove or demonstrate the veracity and reliability of a deduction made by an individual. qualitative observation method [14].

Usually a pendulum movement makes one idea, having reached the limit of the possible, be replaced by another in a way equally radical. It does not seem to me that the emphasis on the quantitative approach to research should now be shifted to the qualitative approach; it would probably not be a gain for research in agricultural economics. The time has probably come to stop building bridges. As a conclusion, one may ask whether the choice of "quantitative" and "qualitative" epithets is appropriate for all possible research approaches to economics. A new paradigm that incorporates different approaches may be the alternative to the two paradigms that have been discussed so far [15].

Quantitative and qualitative approach to agricultural development

Starting from the Austrian economist JA Schumpeter (1911), the first postulates that, the major role of innovations in the impulse, the setting in movement of the economy under the action of the entrepreneur is the manufacture of new products, the adoption of new processes and techniques, the use of new raw materials or the opening of new outlets that structures eventually change. According to Schumpeter it is the entrepreneur and his innovations that can break the spiral of a stationary economy and move to economic evolution. Evolution cannot come from a quantitative change (increase in production or capital), but from the qualitative transformation of the production system. The author shows that the determining factor of this evolution is innovation. This is at the heart not only of the process of growth, but also of more important structural transformations [16].

According to Cochrane (1958) and Gardner (2002), in a small open economy in which producers face an infinitely elastic demand, the gains from technological change accrue entirely to producers in the form of higher profits. On the other hand, if the demand is perfectly inelastic, all the gains belong to the consumers in the form of lower prices. The distribution of welfare gains from technical change therefore depends essentially on the price elasticity of demand for the product. Since most agricultural products have an inelastic price demand, producers in general do not have much to gain from the long-run balance of technological change. Producers adopt new technologies because they reduce unit costs by increasing productivity.

For Azariadis (2005) and Stachursky. J (2005), The standard of living of farmers can be in itself the institutional failure. A common feature of all these mechanisms is their negative impact on the acquisition of physical or human capital and the adoption of modern technology.

Nelson (1996), in turn, shows that persistent underdevelopment can result from demographics. In its model, any increase in income reduces the mortality rate, which increases the population and reduces the capital stock per worker. If the effect on the population is stronger than the decline in yields, then capital per worker cannot increase (Azariadis, 1996). According to Azariadis (1996), in the face of increasing demographic pressure, the stability and the very existence of institutions are called into question. The only escape, as Georgescu-Roegen (1995) will remind us, is the mechanization of agriculture and the practice of new production techniques to improve the quality of products and thus create added value (VA) [17].

Thus, the pitfalls that hinder a considerable improvement in rural living conditions cannot be overcome without understanding and the cautious conception of politics.

Recent developments present an approach by IG (Geographical Indications). Geographical Indications (GIs) are used as a marketing tool to differentiate agri-food products in a globalized market. By definition, they serve to identify a product as originating in the territory of a member where a quality, reputation or other characteristic of the product is essentially attributable to its geographical origin. They typically appear in the form of labels or labels that highlight the origin of the product and link to tangible quality attributes, which tend to increase added value and consumer recognition. One of the benefits of this marketing strategy is that studies show that IG products can generate significant price premiums of up to 40% over non-GI products and returns comparable to those of some major brands. It should be noted that, despite the fact that this strategy of differentiation of products of specific origin originates from industrialized countries, some developing countries have successfully applied GIs and differentiation strategies based on origin and quality, and have benefited from the economic benefits of it. We can mention in particular; Jamaica (Jamaican Blue Montain Coffee), Colombian coffee, Ecuador's cocoa arabica (Monique Baga *et al.*, 2013) [18].

In Cameroon, these ideas drawn from classical literature are translated into the will of public authorities and private actors through the promotion of a fundamental determinant approach to sustainable agriculture. The cocoa sector is a perfect illustration of this quality approach. Indeed, world cocoa production since the 20th century has been growing at a rate of around 2% to 2.5% and reached 1.5 million tonnes in 1964. Today, it exceeds 2 million tonnes, of which Africa alone accounts for nearly 66% (Mossu, 1990). The major producing countries are: Côte d'Ivoire, Ghana, Indonesia, Cameroon and Nigeria (UNCTAD, 2007) [19].

Total world production comes from three production basins: The Gulf of Guinea (Cote d'Ivoire, Ghana, Nigeria, Cameroon, etc.), with total production hovering around 70%; South America, Central America and the Caribbean (Brazil, Ecuador, Peru, etc.), with total output hovering around 16%; South Asia and Oceania (Indonesia, Malaysia, Papua New Guinea, etc.) with total production around 18% (FAO, 2017) [20].

As for the country importing cocoa beans, the main actors are: The United States, Germany, France, the United Kingdom, and the Russian Federation (UNCTAD, 2007) and China, which recently is positioning itself and more like a future Eldorado of this market by 2050. These countries import about 3 million tons of cocoa (Wikipedia, 2009) [21].

The cocoa of better quality is defined by the respect of the international standards in particular the respect of the technical routes during the process of production until the commercialization. Here we mean by technical routes a logical and orderly sequence of cultural operations applied to a species or an association of species cultivated as part of a cropping system (Sebillotte, 1974). For Mossu (1990), this route involves the following operations: the choice and the preparation of the ground; plantation and maintenance of the plantation; harvesting pods and scraping; and the preparation of merchantable cocoa (drying) [22].

The intensification of the technical route according to Varlet and Tchiat (1991) is a quantitative increase of factors of production other than land, and the increase of the yield is only the consequence of this one [23].

International cocoa standards only take into account fermented cocoa after a drying period, provided that the product is tasteless with fumigation, no strange or abnormal odors and no apparent sign of spoilage. It is also desirable that the beans are relatively uniform and homogeneous. In addition, they must not contain shell fragments or be broken or damaged by insects [24].

The international reference for quality standards on cocoa is the Ghana origin. Based on the cut proof, the product is sorted according to the number of defective beans. The limits set by this test are:

Quality I (Grade I): *Moldy beans, maximum 3% per test; *Slate beans maximum 3% per test; *Flat beans, sprouted or attacked by insects, maximum total of 3% per test [25].

Quality II (Grade II): *Moldy beans, maximum 4% per test; *Slate beans maximum 8% per test; *Flat beans, sprouted or attacked by insects, maximum

total of 3% per test. (UN, 2012) [26].

Aspects relating to the quality of cocoa beans

Aroma, Food Safety and Sanitation, Physical Characteristics, Characteristics of Cocoa Butter, Coloring Potency—"Colourability", Traceability, Geographical Indicators and Certification (Dand R *et al.*, 2015) [27].

Aspects of Cocoa Production Affecting Quality Requirements

Pre-harvest, Harvest, Post-harvest, Quality Control, Transportation and Shipping Practices (Dand R *et al.*, 2015).

As far as Cameroon is concerned, the quality is as follows:

During the 2015-2016 campaign, Cameroon doubled its exports of certified cocoa to nearly 20,000 tonnes. Indeed, the cultivation of certified cocoa on the Cameroonian territory makes more and more followers in the population of the producers. According to official statistics (INS *et al.*, 2015), nearly 20,000 tonnes of certified cocoa were exported by Cameroon during the 2015-2016 crop year. This production is up 100% compared to the previous season (2014-2015), after which 10,000 tonnes of certified cocoa had been exported by Cameroon, against 5400 tonnes only during the 2013-2014 campaign. Thus, the production of this cocoa obeying specific requirements enacted by consumers has tripled on the Cameroonian territory during the last three campaigns mentioned above [28].

This craze of producers for certified cocoa is first and foremost the consequence of the certification programs implemented in recent years in the country by companies such as AMS, a subsidiary of the Dutch company Theobroma; Sic Cacaos, Cameroonian subsidiary of the Swiss Barry Callebault; or Telcar Cocoa, a merchant of the American firm Cargill and market leader in certified cocoa in Cameroon [29].

Then there are the large premiums paid to certified cocoa growers, as rewards for the extra effort provided in monitoring the technical routes and other obligations that underlie the production of this cocoa.

For example, in the last three campaigns mentioned above in Cameroon, Telcar Cocoa alone has distributed more than 1.5 billion CFA francs of premiums to certified cocoa producers (Mbodiam B.R, 2016).

Apart from the incentive for good practices for a better quality cocoa offered by the subsidiaries (Telcar Cocoa for example) to cocoa producers, is added the initiative related to the training of cocoa farmers. Indeed, the pool of Cameroonian cocoa farmers trained in good farming practices has been enriched by 11,000 new members, all of whom have received their certificates of completion on September 7, 2016 in Obala, a city in central Cameroon, production area. cocoa from the central region of the country [30].

This new vintage brings to 21,000 the number of cocoa producers trained in Cameroon since 2011, as part of the Cargill Cocoa Promise, implemented in Cameroon by Telcar Cocoa, a local trader of this global cocoa trading giant [31].

Covering the regions of Littoral, South-West, Central and South of Cameroon, this program of supervision and training of producers in cocoa certification has recently been enriched by the Coop Academy initiative. It is an academy of co-

coa farmers' cooperatives, which aims to train about 908 delegates from 227 co-operatives, over a period of 3 years, to transform their organizations into viable, sustainable and profitable businesses (Telcar Cocoa, 2016) [32].

Despite the measures taken for years, the quality of Cameroonian cocoa is not improving. According to the National Office of Cocoa and Coffee (ONCC, 2017), during the 2016-2017 cocoa season, more than 95% of the beans exported by Cameroon were in grade II, compared to 97% in the previous marketing year (2015-2016). The direct consequence of this unattractive quality of Cameroonian beans is that the origin Cameroon has experienced a discount 200 CFA francs per kilogram on the international market, throughout the last season (Atangana.L.MM, 2017).

In order to reverse this trend, the Cameroonian government instituted a quality premium paid at the end of the campaign to the players who stood out during the campaign for the quality of their cocoa production (L.M.M Atangana, 2018). The goal is to encourage cocoa farmers to produce better. This premium will be levied on the share of the royalties allocated to the Cocoa-Coffee Market Development Fund (FODECC) [33].

Payed at the end of the campaign to the actors who have distinguished themselves during the campaign by the quality of their cocoa production, this premium will be levied, we learn, on the share of the fee paid to the Fund for the development of cocoa coffee (Fodecc).

In addition, it is also planned to launch cocoa centers of excellence across the country to train farmers in the best farming techniques. According to official projections, around 4 000 producers could be trained every year with the aim of producing quality cocoa with above-average market prices.

Indeed, this government incentive is in addition to initiatives already undertaken by some exporters who have for years been engaged in the battle to improve the quality of Cameroonian cocoa, by encouraging the production of a certified cocoa.

This is the case of Telcar Cocoa, a local merchant of the American Cargill, which has, during the last four cocoa growing seasons in Cameroon, distributed approximately 1.5 billion CFA francs of premiums to certified cocoa farmers.

This can be explained by the phenomenon of liberalization. Indeed, the liberalization of cocoa marketing has had a negative impact on quality. Exports have had a low propensity to seek improvements in product quality. The adoption in 1992 of the packaging standards of the French Association of Cocoa Trade (AFCC), instead of those of the FAO used by the former National Office for the Marketing of Commodities (ONCPB), resulted in the degradation of the quality of the raw products.

The factors that may explain this deterioration in the quality of cocoa result in non-respect of the technical itineraries of pre- and post-harvest operations. These important operations, even when they are carried out, are not always in line with good practice, especially with regard to Phytosanitary treatments, fermentation and drying. The smells of smoke and tar, pesticide residues, and the

almost disappearance of grade I are the consequences (MINADER, 2014) [34].

The introduction of GIs for Cameroon in the marketing of high-quality specific products could be an effective way to improve product quality, position itself in more profitable niche markets, and help increase agricultural income and contribute to development. Positive externalities can also help improve the overall profile of coffee and cocoa in Cameroon over the long term. The approach is therefore primarily centered on quality rather than quantity, the latter having to follow once the price premiums achieved. The high demand for high quality coffee and cocoa, particularly United States and the EU appears to be advocating for diversification to high quality products (ICCO *et al.*, 2010) [35].

The approach by the quantity aims contrary to the one developed above, to increase the production, the quality will follow by a domino effect due to the external constraints in particular in the respect of the international standards. This approach focuses on the concept of agricultural productivity. Indeed, the theoretical approach of productivity finds all its meaning in that it is a means of measuring agricultural performance. From the physiocratic theory to the neoclassical theory of distribution, it occupies a place of choice in economic thought. This interest has been at the origin of a remarkable evolution of economic theory and the microeconomic theory of production [36].

From the physiocratic theories to the neoclassical theory of distribution, the notion of productivity began to be clarified with the work of Quesnay (1694-1774). This pioneering author, himself a landowner, finds that by incurring higher fees, the land is better grown with less labor and gives its owner a larger product. He deduces what will later be called the agricultural surplus theory. At the same time Turgot establishes on the contrary that the land provides decreasing returns as the less fertile land is cultivated. Malthus takes up this argument by referring to the "limited power of production of the earth" in his "Essay on the Principle of Population" in 1798.

The English classics introduce the notion of labor productivity, to designate the physical performance of work. Research on the causes of Adam Smith's wealth of nations in 1976 opens with a first book on "the causes that have perfected the productive faculties of labor". The agricultural surplus theory establishes above all the role of capital advances in increasing agricultural production, and hence in increasing national income, and then considers agriculture as the sole source of productive wealth of labor as the "quantity of work that the same number of arms can provide" and develops the idea that it can be improved by the "division of labor". Thus, labor productivity gains resulting from it, benefit the wage-earners by encouraging a fall in the prices of manufactured goods [37].

The marginalist school operates a complete reversal of the problem, taking advantage of the work of J. B. Say (1828-1829). The latter author thinks that production involves the productive services of three elements: the industry of man (in the current sense of work), capital, and natural agents. He finds empirically that whoever has one of these elements useful for production may demand remuneration when he gives up his use (Destais and Gillot Chappaz, 2000). Say,

however, will not discuss the question of the quantification of this remuneration nor that of its theoretical justification; which will later lead Von Böhm Bawerk to call it "the founder of the naive theory of productivity".

Jevons (1871), a pioneer of the English marginalist school, lays the foundations for a theory of capital. It states that productivity remains a size attached to work, since it defines the degree of productivity per quantity produced in exchange for a certain amount of wages and a productivity indicator corresponding to the inverse of a cost. fixed unit rate of production. S. Jevons goes further in the analysis of capital income based on the idea of linking the remuneration of the means of production and their marginal contribution to the production. His successors in the neoclassical school, develop an analysis of the marginal returns of capital and the marginal productivity of labor and make them tools of distribution of total income between the factors of production.

The neoclassical economists according to the theory of distribution think that it is not only the land, but also all the factors of production which receive a remuneration equal to their marginal productivity at the optimum. Thus, the American economist John Bates Clark (1847-1938), develops the theorem of the exhaustion of the product. This theorem states that: when the production function is homogeneous of degrees 1, when the factors are remunerated to their marginal productivity, then the income from the production, is fully absorbed by the factors.

Thus, the welfare of farmers through an increase in production would result not only from the division of labor that operates through the following channels: increased skill, reduced downtime and mechanization, itself made possible by simplification of tasks but also efficient and effective use of the combination of factors of production such as land, labor and capital [38].

In view of the literature on agricultural development, there seems to be no clear consensus between the various agricultural policy choices (quality-quantity inking). However, economists agree more or less on the role that could be played by the adoption of new techniques in modern production processes and on the role of new technology in increasing agricultural yields. On the other hand, they seem to disagree on the choice to operate. Some favor the increase of production as a source of productivity and therefore of economic growth to improve the living conditions of rural populations. The latter, subject to international standards, will end up encouraging, in the medium and long term, a production of better quality, which is not only a source of productivity but also of competitiveness. On the other hand, some people criticize this idea. For them, evolution cannot come from a quantitative change (increase in production or capital), but from the qualitative transformation of the production system. These show that the determining factor of this evolution is innovation. This is at the heart not only of the process of growth, but also of more important structural transformations [39].

This theoretical division thus appears to be essential or decisive in the different approaches adopted by our governments to define suitable agricultural poli-

cies that are acceptable and adapted to the specificities of each economy and to competition on the international market. The theoretical inking between quantity and quality in the strategic choices of the governments bases the base of this study. Indeed, the fundamental question of this study is how to improve the living conditions of cocoa farmers in Cameroon? (Smallholder family accounts for about 70% of global cocoa production). Starting from the assumption of mixed approaches (quality-quantity) we will try to provide an answer by examining the particular case of Cameroon [40]-[45].

The rest of the paper is organized as follows: Section 3 presents the methodology and specification of the model; Section 4 presents the statistical results and discussion; Section 5 recommendations; Section 6 will allow us to conclude.

3. Methodology and Specification Model

3.1. Methodology

The objective of this paper is to evaluate the impact of the two cultural approaches (quantitative approach and qualitative approach) taken individually and or mixed on the yield of cocoa in Cameroon over the period 2000 to 2016. The time-series estimation of a bifactorial system (quantity and quality factors) with three equations representative of the three approaches (quantitative, qualitative and mixed approach) by the multiple linear regression model using the ordinary least squares method. It also aims to answer the following question: how to improve the living conditions of cocoa farmers in Cameroon? Starting from a quality-quantity approach.

In order to answer all these questions, a theoretical approach is taken to better understand its impact from the practical point of view in the specific case of Cameroon. The data (quantity, quality and price) in time series associated with this study are from Faostat, INS, ONCC and WB over 16 years (**Appendix**, **Table A1** and **Table A2**).

Working hypotheses:

H1: The quality approach to increase farmers' crop yields would be a worthy option to improve their farm incomes.

H2: The increase in production by the quantity approach would be considered as a source of productivity and therefore of economic growth to improve the living conditions of rural populations.

H3: The mix of approaches would be the necessary and sufficient condition for an efficient and effective market if one wanted to improve the incomes of the cocoa farmers.

3.2. Specification Model

It is a bifactorial analysis (quantity factor and quality factor) through the Multiple Linear Regression Model. This data analysis is done using the ordinary least squares (OLS) method to verify the veracity or otherwise of the assumptions presented above.

Let following the fundamental equation be:

$$Rd_t = f(X_t, Z_t) + \varepsilon_t$$

With,

Rd = Agricultural yield (Cacao culture): Variable explained; X = Quantity factor;

Y = Quality factor

X, Y: Explicative Variables; ε = random term

Let the following system of equations be:

$$\begin{cases} Rd_t = \lambda_0 PQ_t + \lambda_1 S_t + \lambda_2 P_t + \varepsilon_t & (1) \\ Rd_t = \delta_0 (GI/GF)_t + \delta_1 (GII/FF)_t + \delta_2 (HS)_t + \delta_3 (NC)_t + \varepsilon_t & (2) \\ Rd_t = \lambda_0 PQ_t + \lambda_1 S_t + \lambda_2 P_t \delta_0 + \delta_0 (GI/GF)_t + \delta_1 (GII/FF)_t \\ \qquad + \delta_2 (HS)_t + \delta_3 (NC)_t + \varepsilon_t & (3) \end{cases}$$

Notes: Approach by Quantity (1); Quality approach (2); Mixed approach (3).

Rd: agricultural yield in cocoa culture.

PQ = total production of cocoa beans in tonnes in Cameroon.

S = Surfaces harvested in Cameroon.

P = Price of cocoa to planter (Bord Champ in Cameroon).

• Standards in terms of quality:

GI = Grade 1; GradeII = Grade 2; GF = good fermentation; FF = Low fermentation; HS = Out of Standards;

NC = No Compliant.

T = Period = 2000, 2001, 2002 ⋯⋯ 2016; (lamdas and sigmas) i = Model parameters; with i = 0, 1, 2.3;

ε = random term;

X (quantity factor), corresponds to equation 1 above: PQ, S, P;

Y (quality factor), corresponds to equation 2 above: GI/GF, GII/GF, HS, NC.

4. Statistical Results and Discussion

This part is based on the descriptive statistics and implementation of the methodology to verify the hypotheses set out in the introduction. It is divided into three sections: The first section dwells on descriptive statistics and Pearson correlation coefficient of variables used. In the second section, the regression results are presented based on the ordinary least square and in the third section verification of the hypothesis.

4.1. Descriptive Statistics and Correlation between Cultivation Approach and Agricultural Yield of Cocoa

• Descriptive Statistics of Cocoa Production

As shown in Table 1, descriptive statistics of production quantity shows that the value of the mean is 5.300; the minimum value is 5.086, while the maximum is 5.464 and with a standard deviation of 0.139. Descriptive statistics of agricultural yield in cocoa culture (Rd) indicates a mean value 0.033 of which is less

Table 1. Descriptive statistics.

	N	Minimum	Maximum	Mean	Std. Deviation
Production quantity	17	5.086	5.464	5.300	0.139
Surfaces harvested (S)	17	5.562	5.859	5.729	0.109
Agricultural yield(RD)	17	3.518	3.613	3.571	0.033
Out of Standards (HS)	17	4.634	7.002	6.196	0.744
No Compliant (NC)	17	4.399	5.441	5.168	0.268
GI/GF	17	0.100	7.550	2.440	2.006
GII/FF	17	92.26	98.67	96.97	2.201
Price	17	500	1853	983.71	373.61

Sources: Author's conception using research.

than that of production quantity; the minimum value is 3.5183, and the maximum value is 3.613 while the standard deviation of 3.571;

For the descriptive statistics of Surfaces harvested (S), we can notice that the values are larger than those of agricultural yield in cocoa culture (Rd). The descriptive statistics of Surfaces harvested (S) a mean value of 5.562, a minimum value of 5.729, with a maximum value of 5.859 and a standard deviation of 0.109; As concerns the descriptive statistics values of Price of cocoa to planter (P), they are really minimal. With a mean of 5.729, a minimum value of 5.562, a maximum value of 5.859 and a standard deviation of 0.109;

With regards to the descriptive statistics of the Out of Standards (HS) and No Compliant (NC), it can be seen that there has a part to play as far as agricultural productivity is concern. Out of Standards (HS) has a mean value of 6.196, a minimum value of 4.634, a maximum value of 7.002 and a standard deviation of 0.744;

Finally, the descriptive statistics of No Compliant (NC) shows a mean value of 5.168, a minimum value of 4.399, a maximum value of 5.44 and a standard deviation value of 0.268; the same reasoning is valid for descriptive statistics GI/GF and GII/FF respectively.

- Correlation between cultivation approach and agricultural yield of cocoa

The Pearson's Correlation Coefficient (r) is used to measure the strength of the association between two variables. The Pearson Correlation Coefficient measures the strength of the linear relationship between agricultural yield and cultivation approaches of cocoa. Where the relationship between the variables is not linear, then the correlation coefficient does not adequately represent the strength of the relationship between the variables. Pearson's correlation coefficient ranges from −1 to 1. An r of −1 indicates a perfect negative linear relationship between agricultural yield and cultivation approaches of cocoa, an r of 0 indicates no linear relationship between variables, and an r of 1 indicates a perfect positive relationship between agricultural yield and cultivation approaches of cocoa. To investigate the relationship among the constructs, a Zero-order correlation table was generated. The Pearson Correlation Coefficient (r) was em-

ployed to establish the relationship between the variables.

According to the Table 2: From the Pearson correlation table above, we realize that the variables of the quantity approach of cocoa cultivation have a positive effect on agricultural yield. In a more précised manner, the researcher deduced the following:

- Pearson Correlation of production of quality has a positive effect on agricultural yields which is significant at 1% level, with r = 0.922;
- While the Pearson Correlation of Surfaces harvested (S) has a positive effect on agricultural productivity which is significant at 1% level and positive, with r = 0.993;
- The Pearson correlation of price of planter has a positive effect on agricultural productivity but this effect is significant with r= 0.716;
- The Pearson correlation of surfaces has a positive effect on price which is significant at 1% level but positive, with r = 0.684.

According to Table 3: From the Pearson correlation table above, we realize that the variables of the quality approach of cocoa cultivation have a positive effect on agricultural yield. In a more précised manner, the researcher deduced the following:

- Pearson Correlation of HS has a positive effect on agricultural yields which is significant at 1% level, with r = 0.943;
- While the Pearson Correlation of NC has a positive effect on agricultural productivity which is significant at 1% level and positive, with r = 0.993;
- The Pearson correlation of GII/FF has a positive effect on agricultural productivity but this effect is significant with r= 0.823;
- The Pearson correlation of GI/GF has a positive effect on price which is insignificant at 1% level but positive, with r = 0.079.

Table 2. Correlation analysis of quantity approach.

		Production quantity	Surfaces harvested (S)	Agricultural yield	Price
Production quantity	Pearson Correlation	1	0.993**	0.922**	0.716**
	Sig. (2-tailed)		0.000	0.000	0.001
	N	17	17	17	17
Surfaces harvested (S)	Pearson Correlation	0.993**	1	0.869**	0.684**
	Sig. (2-tailed)	0.000		0.000	0.002
	N	17	17	17	17
Agricultural yield	Pearson Correlation	0.922**	0.869**	1	0.748**
	Sig. (2-tailed)	0.000	0.000		0.001
	N	17	17	17	17
Price	Pearson Correlation	0.716**	0.684**	0.748**	1
	Sig. (2-tailed)	0.001	0.002	0.001	
	N	17	17	17	17

**Correlation is significant at the 0.01 level (2-tailed). Sources: Author's conception using research data with SPSS.

Table 3. Correlation analysis of quality approach.

		Agricultural yield	GII/FF	HS	NC	GI/GF
Agricultural yield	Pearson Correlation	1	−0.033	0.943**	0.823**	−0.079
	Sig. (2-tailed)		0.900	0.000	0.000	0.763
	N	17	17	17	17	17
GII/FF	Pearson Correlation	−0.033	1	−0.012	−0.109	−0.444
	Sig. (2-tailed)	0.900		0.963	0.678	0.075
	N	17	17	17	17	17
HS	Pearson Correlation	0.943**	−0.012	1	0.702**	−0.173
	Sig. (2-tailed)	0.000	0.963		0.002	0.507
	N	17	17	17	17	17
NC	Pearson Correlation	0.823**	−0.109	0.702**	1	−0.031
	Sig. (2-tailed)	0.000	0.678	0.002		0.907
	N	17	17	17	17	17
GI/GF	Pearson Correlation	−0.079	−0.444	−0.173	−0.031	1
	Sig. (2-tailed)	0.763	0.075	0.507	0.907	
	N	17	17	17	17	17

**Correlation is significant at the 0.01 level (2-tailed). Sources: Author's conception using research data with SPSS.

4.2. OLS Regression

After the descriptive statistic and the Pearson correlation, we have applied in subsequent regression analysis where the dependent variable was regressed against each of the cultivation approach variables. In this section, we shall evaluate in a precise manner, the impact of cultivation approach on agricultural yield of cocoa.

- Regression Analysis of Quantity Approach

From the Ordinary least square Regression, we shall present the impact of each of the different dimensions of Quantity approach on agricultural yield of cocoa in Cameroon; we shall start by presenting a summary of the model as seen in Table 4.

According to Table 4: The above R-squared shows the percentage of total variation of the dependent variable explained by the independent variable. This implies that cultivation approach variables have a positive effect on agriculture productivity. According to the analysis for the above regression, R -squared is 0.98 (98%). This shows that the quantity approach variables are related enough to explain variations in agricultural productivity. We see from the table above that our coefficient of determination R square is 0.98 (98%) which means that 98% of agricultural productivity is explained by our independent variables. This shows that our model is good and is well explained by our independent variables. We are going to verify the global significance of this model using the ANOVA test.

Table 4. Model summary.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	0.990[a]	0.980	0.975	45.027

a. Predictors: (Constant), Prix moyen au planteur (per kg) en FCFA, Production Area Harvested (ha), Production Quantity (tons). Sources: Author's conception using research data with SPSS.

We see that globally our model is good; the critical value of our F-statistics is significantly greater than that in the table of t-statistics thus indicating that globally our model is good. In a précised manner the table below shows us the regression coefficients of our independent variables against the dependent variable (agricultural yield) (Table 5).

From the regression results, Production Quantity (tons) on its part exerts a positive impact on agricultural productivity Cameroon with a regression coefficient of 0.016, implying that a unit variation in Production Quantity (tons) will lead to an increase variation in agricultural productivity by 0.016; surfaces Harvested has a positive impact on agricultural productivity with a regression coefficient of 0.006 still, from the regression results, Price of the planter (per kg) FCFA a positive impact on cocoa production farming in Cameroon with a regression coefficient of 0.036 implying that a unit variation in Price of the planter (per kg) FCFA will lead to an increase in the productivity of cocoa in Cameroon by 0.036 (2.2%). This result confirms the results gotten through the Pearson correlation coefficient and can be presented econometrically as seen below: pesticides have a negative impact on the farming of cocoa and cotton in Cameroon with a regression coefficient of −.068 and machinery turn out to have a positive effect on the cultivation of cocoa and cotton in Cameroon, with a regression coefficient of 0.064 (Table 6).

- Regression Analysis of Quality approach

From the Ordinary least square Regression, we shall present the impact of each of the different dimensions of quality approach on agricultural yield of cocoa in Cameroon; we shall start by presenting a summary of the model as seen in Table 7.

The above R-squared shows the percentage of total variation of the dependent variable explained by the independent variable. This implies that quality approach variables have a positive effect on agriculture productivity. According to the analysis for the above regression, R -squared is 0.912 (91.2%). This shows that the quality approach variables are related enough to explain variations in agricultural productivity. We see from the table above that our coefficient of determination R square is 0.912 (91.2%) which means that 0.912 (91.2%) of agricultural productivity is explained by our independent variables (quality approach variables). This shows that our model is good and is well explained by our independent variables. We are going to verify the global significance of this model using the ANOVA test (Table 7).

We see that globally our model is good; the critical value of our F-statistics is

Table 5. ANOVA[a].

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1,266,416.749	3	422,138.916	208.216	0.000[b]
Residual	26,356.309	13	2027.408		
Total	1,292,773.059	16			

[a]Dependent Variable: Production/Yields(hg/ha); [b]Predictors: (Constant), Prix moyen au planteur (par kg) en FCFA, Production Area Harvested (ha), Production Quantity (tons). Sources: Author's conception using research data with SPSS.

Table 6. Coefficients[a].

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	0.349	0.087		4.011	0.000
Production Quantity (tons)	0.016	0.001	3.451	10.842	0.000
surfaces Harvested (ha)	0.006	0.001	2.586	8.481	0.000
Price of the planter (per kg) FCFA	0.036	0.045	0.047	0.804	0.436

[a]Dependent Variable: Production/Yields (hg/ha). Sources: Author's conception using research data with SPSS.

Table 7. Model summary[a].

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.955[a]	0.912	0.883	97.272

[a]Predictors: (Constant), NC, GI/GF, HS, GII/FF. Sources: Author's conception using research data with SPSS.

significantly greater than that in the table of t-statistics thus indicating that globally our model is good. In a précised manner the table below shows us the regression coefficients of our independent variables (quality approach variables) against the dependent variable (agricultural productivity) (Table 8).

From the regression results, GI/GF on its part exerts a positive impact on agricultural productivity Cameroon with a regression coefficient of 0.870, implying that a unit variation in GI/GF will lead to an increase variation in agricultural productivity by 0.870; GII/FF has a positive impact on agricultural productivity with a regression coefficient of 0.023 still, from the regression results, HS exerts a positive impact on cocoa farming production in Cameroon with a regression coefficient of 0.644 implying that a unit variation in HS will lead to an increase in the productivity of cocoa in Cameroon by 0.644 (64.4%), NC has a positive impact on the cultivation of cocoa in Cameroon with a regression coefficient of 0.019. this result confirms the results gotten through the Pearson correlation coefficient above (Table 9).

- Regression Analysis of mixed approach

From the Ordinary least square Regression, we shall present the impact of

Table 8. ANOVA[a].

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1,179,230.895	4	294,807.724	31.158	0.000[b]
Residual	113,542.164	12	9461.847		
Total	1,292,773.059	16			

[a]Dependent Variable: Production/Yields (hg/ha); [b]Predictors: (Constant), NC, GI/GF, HS, GII/FF. Sources: Author's conception using research data with SPSS.

Table 9. Coefficients[a].

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.370	0.168		2.202	0.000
GI/GF	0.870	0.180	0.009	4.833	0.025
GII/FF	0.023	0.009	1.647	2.555	0.000
HS	0.644	0.150	0.728	4.293	0.012
NC	0.019	0.100	0.053	0.197	0.847

[a]Dependent Variable: Production/Yields (hg/ha). Sources: Author's conception using research data with SPSS.

each of the different dimensions of the mixed approach on agricultural yield of cocoa in Cameroon; we shall start by presenting a summary of the model as seen in Table 10.

The above R-squared shows the percentage of total variation of the dependent variable explained by the independent variable. This implies that mixed approach variables have a positive effect on agriculture productivity of cocoa. According to the analysis for the above regression, R-squared is 0.982 (98.2%). This shows that the mixed approach variables are related enough to explain variations in agricultural productivity. We see from the table above that our coefficient of determination R square is 0.982 (98.2%) which means that 98.2% of agricultural productivity is explained by our independent variables. This shows that our model is good and is well explained by our independent variables. We are going to verify the global significance of this model using the ANOVA test (Table 10).

We see that globally our model is good; the critical value of our F-statistics is significantly greater than that in the table of t-statistics thus indicating that globally our model is good. In a précised manner the table below shows us the regression coefficients of our independent variables (mixed approach variables) against the dependent variable (agricultural yield) (Table 11).

From the regression results, Production Quantity (tons) on its part exerts a positive impact on agricultural productivity Cameroon with a regression coefficient of 0.016, implying that a unit variation in Production Quantity (tons) will lead to an increase variation in agricultural productivity by 0.016; surfaces

Table 10. Model summary.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.991[a]	0.982	0.972	47.683

[a]Predictors: (Constant), NC, GI/GF, Prix moyen au planteur (par kg) en FCFA, HS, Production Area Harvested (ha), Production Quantity (tons). Sources: Author's conception using research data with SPSS.

Table 11. ANOVA[a].

	Model	Sum of Squares	df	Mean Square	F	Sig.
	Regression	1,270,036.107	6	211,672.685	93.096	0.000[b]
1	Residual	22,736.952	10	2273.695		
	Total	1,292,773.059	16			

[a]Dependent Variable: Production/Yields (hg/ha); [b]Predictors: (Constant), NC, GI/GF, Prix moyen au planteur (par kg) en FCFA, HS, Production Area Harvested (ha), Production Quantity (tons). Sources: Author's conception using research data with SPSS.

Harvested has a positive impact on agricultural productivity with a regression coefficient of 0.006 still, from the regression results, Price of the planter (per kg) FCFA a positive impact on cocoa production farming in Cameroon with a regression coefficient of 0.011 implying that a unit variation in Price of the planter (per kg) FCFA will lead to an increase in the productivity of cocoa in Cameroon by 0.011 (1.1%), other variables like GI/GF, HS and NC has a positive but insignificant impact on agricultural yield in Cameroon.This result confirms the results gotten through the Pearson correlation coefficient (Table 12).

Section 3: Verification of Hypotheses (H_1 and H_2)

The results obtained from the OLS regression and the Pearson Correlation demonstrates that cocoa cultivation approaches exert a positive impact on agricultural yield in Cameroon.

Hypothesis I

Hence we can conclude that the quality approach increase farmers' crop yields and has positive and significant relationship, which goes to accept our first hypothesis (H1) which states that, the quality approach to increase farmers' crop yields would be a worthy option to improve their farm incomes.

Hypothesis II

Hence we can conclude that the quantity approach increase farmers' crop yields and has positive and significant relationship, which goes to accept our second hypothesis (H2) which states that, the increase in production by the quantity approach would be considered as a source of productivity and therefore of economic growth to improve the living conditions of rural populations.

Hypothesis III

Hence we can conclude that the mixed approach increase farmers' crop yields and has positive and significant relationship, which goes to accept our third hypothesis (H3) which states that, the mix of approaches would be the necessary and sufficient condition for an efficient and effective market if one wanted to improve the incomes of the cocoa farmers.

Table 12. Coefficients[a].

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	0.343	0.110		0.031	0.000
Production Quantity (tons)	0.016	0.002	3.502	9.675	0.000
surfaces Harvested	0.006	0.001	2.547	7.789	0.000
Price of the planter (par kg)	0.011	0.051	0.015	0.219	0.831
GI/GF	0.961	3.003	0.026	0.320	0.571
HS	1.099	0.893	0.142	1.230	0.247
NC	0.250	0.912	0.062	0.274	0.621

[a]Dependent Variable: Production/Yields (hg/ha). Sources: Author's conception using research data with SPSS.

From our results obtained in the Pearson Correlation and the OLS regression, we realize that this Hypothesis can be accept because all it its variables have a positive relationship on crop yield in Cameroon as shown in Table 13.

The schematically representation or operationalization of our hypothesis can be seen on the Figure 1.

Figure 1 shows the relationship between the Quality approach, Quantity approach, mixed approach and agricultural yield has a positive relationship.

In a conclusive manner, this part has permitted us to present a description of our sample population, the presentation and interpretation of our research results which was the evaluation of the relation between cultivation approaches and agricultural yield.

5. Recommendation on Economic Policy

This study focused on two main questions: what is the impact of the two cultural approaches (approach by quantity and approach by quality) taken individually or mixed on the yield of cocoa in Cameroon? and, how to improve the living conditions of cocoa farmers in Cameroon starting from a quantity-quality approach?

On the basis of the results obtained from this research, some recommendations may be proposed to the Cameroonian Government in the field of agricultural policy in the cocoa sector.

1) The Cameroonian authorities in charge of agricultural policy should focus their choice on the mixed approach for a cocoa farming that is not only profitable but also sustainable if they want to reach the 2020 targets set in the PRDCC (600,000 tons of cocoa). This approach has the advantage of integrating the quantity approach and the quality approach.

2) About 95% of Cameroon's cocoa is exported in the raw state and only about 5% of the cocoa is processed locally. The government of Cameroon must therefore more articulate its agricultural policy around industrialization through
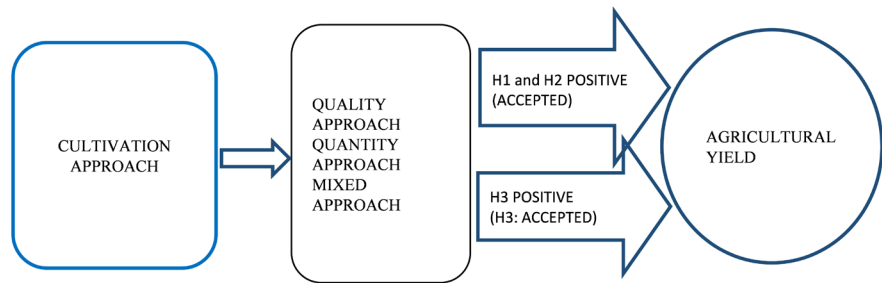
Figure 1. Schematically representation of hypothesis.

Table 13. Verification of hypothesis.

Variables	Impact on agricultural yield	Significance	Decision
Quantity approach	positive	Significant	Accepted
Quantity approach	positive	Significant	Accepted
mixed approach	positive	Significant	Accepted

Source: author's conception.

the creation of structures in charge of local processing of cocoa because it creates added value.

3) The adoption of new technologies to make our production profitable is essential. The government must, however, surround itself with qualified professionals to train farmers in the use and new production techniques while preserving a healthy and non-polluting environment. Thus, extension programs are needed in the production process

4) Respect for international standards in terms of quality necessarily entails the respect of technical itineraries in the production process. Industry experts and the government must go in this direction to improve the perception of the Cameroon label in the international market. In addition to the GI (Geographic Indicator) approach, it also seems to be one of the ways to improve the quality of cocoa from Cameroon. All these recommendations will be aimed at improving the living conditions of producers.

6. Conclusion

In conclusion, in this paper it was question of evaluate the impact of the two cultural approaches (quantitative approach and qualitative approach) taken individually and or mixed on the yield of cocoa in Cameroon over the period 2000 to 2016. The results of the study show that: 1) From the Pearson correlation, we realize that the variables of the quantity approach of cocoa cultivation have a positive effect on agricultural yield; 2) From the Pearson correlation, we realize that the variables of the quality approach of cocoa cultivation have a positive effect on agricultural yield; 3) The different analyzes on the regression coefficients and the ANOVA test applied on the various approaches show that the different variables of the model have a positive impact on agricultural yield by increasing cocoa productivity in Cameroon. However, the qualitative variables HS and NC

are not significant. Thus, the assumptions made are all verified; the quality approach to increase farmers' crop yields would be a worthy option to improve their farm incomes (h1). The increase in production by the quantity approach would be considered as a source of productivity and therefore of economic growth to improve the living conditions of rural populations (h2). The mix of approaches would be the necessary and sufficient condition for an efficient and effective market if one wanted to improve the incomes of the cocoa farmers. Cameroon would benefit not only by adopting the mixed approach but also by putting more emphasis on the quality of cocoa notably through the respect of technical itineraries, international standards, and the education of planters and the use of new methods of farming production. Moreover, the introduction and adoption of new technology through the process of industrialization may stimulate local processing of cocoa. All this will not only stimulate growth, but also to have a better perception on the Cameroonian origin in the international market.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix

Table A1. Quantity production, harvested area, production/yields, average price to planter.

Years (t)	Production Quantity (tons)	Production Area Harvested (ha)	Production/Yields (hg/ha)	Prix moyen au planteur (par kg) en FCFA
2000	122,600	371,742	3298	580
2001	122,100	364,753	3347	700
2002	125,000	365,938	3416	700
2003	154,965	450,000	3444	500
2004	166,754	490,000	3403	600
2005	140,000	400,000	3500	690
2006	164,553	440,000	3740	800
2007	212,619	550,000	3866	937
2008	229,203	590,000	3885	1152
2009	235,500	600,000	3925	1853
2010	264,077	670,000	3941	1491
2011	240,000	670,000	3582	925
2012	268,941	670,000	4014	900
2013	275,000	670,000	4104	1095
2014	269,418	670,000	4021	1250
2015	272,335	678,738	4012	1500
2016	291,512	723,853	4027	1050

Sources: Faostat/Oncc, 2017.

Table A2. Quality of cocoa from 2000/2001 to 2012/2013 (Kg).

	GI/GF	%	GII/FF	%	HS	%	NC	Residus	Total
2000	2,104,618	2.00	103,126,305	98.00	0	-	0	0	105,230,923
2001	2,624,738	3	84,866,541	97.00	-	-	-	-	87,491,279
2002	1,377,170	1.29	105,151,276	98.67	43,080	0.04	-	-	106,571,526
2003	1,289,210	1.11	114,488,589	98.89	-	-	-	-	115,777,799
2004	1,756,740	1.41	123,275,370	98.59	-	-	-	-	125,032,110
2005	6,069,360	5.07	113,409,659	94.72	250,800	0.21	-	-	119,729,819
2006	10,796,280	7.55	131,853,802	92.26	234,240	0.16	25,080	-	142,909,402
2007	1,805,760	1.11	160,004,220	97.94	1,407,938	0.86	144,706	-	163,362,624
2008	2,377,508	1.28	178,838,608	96.53	3,994,082	2.16	52,080	-	185,262,278
2009	175,560	0.10	171,285,323	98.57	2,185,415	1.26	100,320	21,285	173,767,903
2010	2,936,521	1.44	197,828,701	97.28	3,014,237	1.25	-	48,000	203,355,822
2011	5,783,540	-	173,219,958	-	3,014,237	-	25,080	84,577	182,127,312
2012	727,320	-	196,380,485	-	8,120,209	-	99,940	361,346	205,689,300

Source: ONCC, 2015. Note: GF = Good Fermented; FF = Fair Fermented; FAO norms: GI = Grade I; GII = Grade II; HS = Hors Standard.