International Journal of Economics & Management Sciences

DOI: 10.4172/2162-6359.1000456

Research Article Open Access

Organic Farming: A Path of Sustainable Development

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Abstract

Today, everyone has at least heard of organic and organic agriculture. Organic farming is an agricultural system that is fully consistent with sustainable development approach. It is an agricultural production management system that uses no chemical fertilizers, pesticides, an industrial synthetic product or a genetically modified organism.

Organic agriculture is a factor of sustainable development: for society (health, employment…), the environment (methane emission, water resource…) and the economy (Source of Wealth…).

The general objective of the proposed research is to theoretically and empirically evaluate the contribution of organic farming to sustainable development via the three pillars. We will deal with the case of the countries in the Mediterranean surrounding and then we will study the case of Tunisia.

Keywords: Organic agriculture; Sustainable development; Countries around the Mediterranean

Introduction

Most countries, nowadays, are facing a major environmental challenge. In recent decades, emerging issues such as the destruction of the ozone layer, global warming, loss of biodiversity, pressures on natural resources and the recent economic crisis have led to the need for a more environmental friendly growth model.

It is erroneous to learn how to improve the living conditions of all the citizens of the world through definitively exhausting the Earth. And how we can satisfy the needs of today's men while leaving the Earth in good condition for the generations that will inhabit it after us. Therefore, by learning how to economically and equitably share resources, using technologies that pollute less, waste less water and less energy, and especially by changing our consumption patterns and behaviors. That is sustainable development. It is not a step backwards, but a progress for humanity: that of consuming not less, but better [1].

In this article, we seek to evaluate the contribution of organic farming to the social, economic and ecological poles of sustainable development. Evaluate the contribution of organic farming to sustainable development for countries throughout the Mediterranean.

This work will enable us to situate organic farming within the three-dimensional conception of sustainable development. In this conceptual framework, we will bring forward perspectives that will make organic farming more sustainable. To do this, in the first part, we will advance the definition of sustainable development and organic farming. Then, the performance of the AB: (i) economic performance, (ii) environmental performance, and (iii) social performance. In addition, the second part will be devoted to the methodology, finally the conclusion.

The Performance of Organic Farming

Conceptualizations

The concept of sustainable development is, today, omnipresent in speeches. In connection with the Brundtland Report, it is defined as "a mode of development that meets the needs of the present without compromising the ability of future generations" (First definition given by Mrs. Gro Harlem Brundtland, Prime Minister of Norway in 1987) [2]. Many authors agree on this concept. According to Candice Stevens [2] sustainable development "encompasses three dimensions of well-being economic, environmental and social" [3]. So it is based on three pillars: The ecological or environmental pillar relates to respect for the environment, the natural dynamics and the management of natural resources. The economic pillar refers to efficiency, dynamics, and economic coherence. The social pillar deals with questions of social equity, solidarity, social ties and cultural identity. Vaillancourt [3,4] argues that sustainable development presents an interesting approach that allows us to face environmental, economic and socio-political problems. He pointed out that the most interesting part of the concept of sustainable development was not how to conceive it, but rather how it was to be realized and instituted at the international, regional, national and local levels, and in the various sectors of society and the environment.

The concept of sustainable development extends to all human activities, applying this concept to agriculture, agriculture is one of the areas most concerned with the issue of sustainable development [5,6]. Agriculture is a privileged area of concretization because of the significant environmental, economic and social impacts of agrarian systems on a global scale. Thus, popular awareness of the absurdities of modern agriculture requires the replacement of more sustainable alternatives based on environmentally friendly agriculture. The establishment of sustainable agriculture is nevertheless beneficial to rural development and essential for restoring ecosystems that are often much degraded. Thus, the contribution of agriculture to development is a historical evidence, Its potential contribution to sustainable development is a strong hypothesis, given the interactions between agricultural activities and economic, social and ecological balances [7,8]. This contribution assumes that the practices of agriculture are themselves sustainable, that is to say in particular respectful of the

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Received July 26, 2017; **Accepted** August 21, 2017; **Published** August 22, 2017

Citation: Ahlem Z, Hammas MA (2017) Organic Farming: A Path of Sustainable Development. Int J Econ Manag Sci 6: 456. doi: 10.4172/2162-6359.1000456

environment, but also that agriculture as a whole contributes to a more sustainable development of the societies.

One of the first authors who questioned sustainability in agriculture was Gordon Douglas in 1984. It identifies three ways to address this sustainability:

- Productivity, or how agricultural production processes are sustainable;
- The biological and ecological processes underlying production;
- Community entry; It is about social life, the intensity of interactions, access to and control over technologies [9].

At the global level, there is a general consensus on the need and urgency of gradually transforming conventional farming practices to make them more sustainable [10]. So the farmer will have to adopt a different strategy to move towards sustainable agriculture. Thus, the term "sustainable agriculture" simply refers to the application to the agricultural domain of the concept of sustainable development.

Given the problems caused by conventional agriculture (excessive use of inputs pollutes rivers and soils, depletion of groundwater, pollutes the atmosphere, contributes to climate change, etc.) It is now time to seriously consider the implementation of more sustainable agricultural practices at both environmental and socio-economic levels. Indeed, it is necessary to feed populations properly, but in a way that rebuilds the soil and keeps the ecosystems healthy [11]. Several studies have come to the conclusion that sustainable agriculture calls for the promotion and practice of economically viable, environmentally sound and socially equitable agriculture [12-16].

It is a sustainable agriculture that meets today's needs (healthy food, quality water, employment and quality of life) without jeopardizing natural resources for future generations. And that helps feed the world's population.

Thus, organic farming is one of the most known sustainable modes of agricultural production in the consumer. All organic farming systems respect the basic principles of sustainable agriculture [17]. Organic farming therefore aims to be an agriculture that respects the land, the environment, products and animals in order to offer consumers a quality, healthy, unprocessed or modified production. Over the past decade, global consumption of organic products has more than tripled and this trend is steadily increasing [18]. Access to this market is a challenge for developing countries, but also an opportunity to export their agricultural products. Moreover, the production of organic foods seems to constitute a sustainable development path for the agriculture of these countries, since this agriculture is associated with the preservation of resources, financial stability and positive social impacts [19-25]. Organic farming is a means of sustaining the environmental and social economic benefits of agriculture, and this agricultural model presents a promising path for sustainable development.

The three dimensions of sustainability

We will treat organic farming as a utopia since organic farming is an agriculture that is at the center of the three economic, social and environmental pillars of sustainable development.

Economic pillar

The relationship between economic growth and organic farming has been widely debated in recent years.

The results obtained upon this relationship make it possible to define appropriate economic policies to improve human well-being. Organic agriculture undoubtedly affects economic growth, which is why organic agriculture has been (and still is) often used as a means to an end. The development of AB has a positive impact on the social and economic dynamics of rural areas, especially those with a low population size.

Integrating organic agriculture into the agricultural sector will provide an opportunity to join the international biological and fair trade movement, protecting producers from fraud, improving living conditions and providing healthy food [26].

According to the Secretary-General of UNCTAD, Mr. Supachai Panitchpakdi and Mr. Achim Steiner, Executive Director of UNEP, affirmed that: "Organic farming can more easily lead to food security than most conventional systems and is more likely to be sustainable in the long term" [27]. The most attractive feature of this sector is the growth rate of the organic market in these countries. During the second half of the 1990s a steady and strong growth rate in the sale of organic products provided these products with added value [28]. Changes in dietary habits in parts of the populations of developed countries have contributed to this growth.

Due to several food risks, consumers in European countries have become increasingly aware and more critical when buying food products and willing to pay for the organic value added which is the main factor in the economic profitability of the organic sector.

Indeed, the economic profitability of organic farming is mainly due to the added value that the producers receive for their productions.

As a result of this increase in demand, many governments have announced the implementation of ambitious plans to promote organic farming in developed countries. Similarly, the same was done for developing countries. And, since demand in developed countries is structurally superior to domestic supply, it resulted in an adjustment through the import of organic products from developing countries. For example, producers in developing countries have some advantage in organic production, as traditional agricultural systems generally do not use chemical inputs, and because of increased exports of organic products, these countries have no technological advantage so they can support this point to contribute to the success of their economies and reduce their dependence on external inputs.

The environmental pillar

Agriculture is at the interface of many major environmental issues such as the climate challenge, the preservation of soil quality, water and air. These negative impacts force us to think about new modes of production more respectful of the environment. As such, the transition to organic farming may be an interesting alternative.

Organic Agriculture is cited in all the scenarios of the Agriculture-Energy 2030 prospective as one of the elements of the strategy of action to reduce the energy footprint of the agricultural sector.

Organic farming is a mode of production based notably on the non-use of synthetic chemicals, recycling of organic matter, crop rotation and biological control.

Throughout the chain, operators engaged in organic production and processing comply with rigorous specifications that favor non-polluting processes that respect the ecosystem and animals.

Organic farming contributes to better preservation of the different environments: soil, water, greenhouse gas emissions and it promotes sustainable biodiversity.

Water: Water is an indispensable resource for agriculture, without which no production is possible. In this sense, we share all the recommendations aimed at optimal management and use of water in order to enable agriculture to meet its essential mission of feeding the population [29].

Thus, from the perspective of water consumption, there is a considerable difference between conventional and organic farming. In Australia, Wood et al. showed that conventional farms consume 6 times more water than organic farms [30]. In addition, the use of bio-pesticides and bio-fertilizers presents fewer risks to water resources than the use of conventional agricultural chemicals [31]. Moreover, water quality studies in Europe conclude that organic farming generally has lower rates of pesticide infiltration than conventional and integrated agriculture and similar infiltration rates for the nitrates [32].

To conclude, organic farming contributes to an improvement of the quality of the water. Besides, natural water resources are more protected and their use is more efficient in organic farming.

Emission of greenhouse gas: Agriculture is the source of a quarter of global greenhouse gas emissions. Agriculture emits two main greenhouse gases: methane (CH_4) and nitrous oxide (N_2O). About half of the emissions from the agricultural sector come from the use of fertilizers, of synthetic or animal origin, which has high nitrogen content, and half of the livestock.

Organic farming is a key sector contributing to the national objectives of combating global warming.

The social pillar: Organic farming requires more labor than conventional agriculture, improving working conditions for farmers and fulfilling its primary mission of providing healthy food for the population. We will analyze the social performance across two broad categories of performance: AB's contribution to employment and health. These two categories of social performance are presented successively.

Employment: One of the important economic impacts of biological enterprises on the socio-economic environment is job creation. The use of labor, whether measured in hours or in number of employees per hectare, is generally higher among organic farming enterprises.

These higher labor requirements in organic farming are due to the increased work generated by the replacement of chemical inputs through fertilization practices and the use of complex crop rotations and diversity of crops, which would generally result in more manual labor (soil maintenance, manual and/or mechanical weeding, etc.) [33]. Organic farming is more labor intensive, which should therefore promote employment in rural areas and limit rural urban migration.

Health: Organic farming must maintain and improve the health of the soil, plants, animals, human beings and the planet as one indivisible unit. In other words, this principle states that the health of individuals and communities cannot be separated from the health of the ecosystem. Indeed, healthy soils produce healthy foods that positively influence the health of animals and humans.

Similarly, it should be noted that the concept of health targeted goes beyond the mere notion of the absence of disease to touch notions such as physical, social, mental and ecological well-being. Thus, the role of organic farming is to maintain and improve the health of ecosystems ranging from the smallest organisms in the soil to the human being. This requires the production of high-quality nutritious foods while avoiding the use of chemicals that bring a health risk.

One of the first motivations of consumers to buy organic food is based on health and nutrition concerns [34,35]. The latter are, therefore, willing to pay a generally a higher price because they consider that the intrinsic characteristics of these foods are superior to those of conventional products.

Conversion to organic farming reduces pesticide-related health problems and the chemical fertilizers that are found in foods that they contaminate humans. Our body does not know how to manage these unnatural elements. It accumulates them in our bodies until a certain time or the body develops anomalies (e.g. cancer).

By working on these three pillars, the development of organic farming meets all dimensions of sustainable development.

Empirical investigation

Several studies have shown that organic farming presents a promising path for sustainable development, such as the work of Jean-Louis Louis Brangeon et al., Morvan et al.; Giovannucci, Sylvie Bonny, Nemes, Borron, Bouagnimeck, Badgley et al., Virginie Journeau [36-39].

In this respect, several methods can be applied to empirically evaluate the contribution of organic farming to sustainable development: using the Bioeconomic modeling method, Arfini, Kruseman, Argent, Sterk et al., Blazy et al. To the good from a method of qualitative analysis: To make a case study mention the work of Khalil Roukoz. Alternatively, using the IDEA method (Sustainability Indicators of Farms): (Mitchell and Girardin, Zahm F; Vilain; Gras; Mouche C.

Presentation of the model

In this research perspective, our empirical investigation is inspired by the work of V. Costantini and S. Monni (the relationship linking economic growth to the three fundamental pillars of sustainable development) in order to test the relationship linking organic agriculture to the three basic pillars of sustainable development (economic, social and environmental).

It is in this research perspective that this work is integrated: the application of the principles of sustainable development to organic farming. The question, we are attempting to provide some answers to, is to evaluate the contribution of organic farming to sustainable development and to the economic, social and environmental impacts. It is therefore a matter of ensuring production in compliance with the ecological, economic and social limits which ensure the sustainability of this production over time. That is why we have opted mainly for a quantitative analysis for countries in the Mediterranean region that can assist us in analyzing the three dimensions of sustainable development.

The model to be estimated is written as follows:

$Y_{it}=\alpha+\beta x_{it}$

With: Y_{it} is the biological area and x_{it} is the matrix of macroeconomic explanatory variables (indicators of sustainable development).

t: 2004- 2012

i: 1,…, N (N=10 country).

Our sample is composed of the following countries: Morocco, Egypt, Turkey, Italy, Spain, Greece, France, Portugal, Algeria, and

Tunisia. The choice of countries and the year of study are guided by the overall context of the study and the availability of data.

The data used are developed on the basis of FAO and World Bank statistics. The explanatory variables are as follows:

-The economic pillar can be represented by gross domestic product (GDP) or per capita income.

-Concerning the environmental pillar, two determining variables, in particular methane emission (ME) and agricultural water withdrawal (AW).

-And, health expenditure (HE) and employment in agriculture (EA) as key indicators of social pillar.

-Based on a model of the contribution of organic farming to sustainable development. We propose to use panel econometric methods to estimate these equations.

This model can be estimated in 3 pillars

1st pillar: explores the impact of organic agriculture (via biological area (BA)) on economic growth (GDP).

This relationship is estimated using the following equation:

$$\ln(GDP)_{it=}\alpha_0+\alpha_1\ln(BA)_{it} + \varepsilon_{it} \quad (1)$$

With GDP: gross domestic product; BA: biological area

2nd pillar: the study of the effect of organic farming using the biological area (BA) as an environmental measurement index measured by methane emission (ME) and water retreat (WR) Using equation (2.1) and (2.2).

$$\ln(ME)_{it=}\alpha_0+\alpha_1\ln(BA)_{it} + \varepsilon_{it} \quad (2.1)$$

$$\ln(WR)_{it=}\beta_0+\beta_1\ln(BA)_{it} + \varepsilon_{it} \quad (2.2)$$

3rd pillar: access to the study of the effects of organic agriculture on social equity as measured by health expenditure (HE) and employment in agriculture (EA).

$$\ln(HE)_{it=}\alpha_0+\alpha_1\ln(BA)_{it} + \varepsilon_{it} \quad (3.1)$$

$$\ln(EA)it=\beta0+\beta1\ln(BA)it + \varepsilon it \quad (3.2)$$

In this attempt of the empirical study, we want to know if there is a correlation between the main pillars of sustainable development (social, economic and environmental) and organic agriculture, for the countries in the whole Mediterranean.

Analysis of results

The model estimates are by the double least square method (DLS)

• **1st pillar:** Estimate the following linear relationship:

$$\ln(GDP)_{it=}\alpha_0+\alpha_1\ln(BA)_{it} + \varepsilon_{it} \quad (4)$$

Where α_0 the constant and ε_{it} the error term,

The purpose of this first equation and whether the relationship between biological area (BA) and economic growth (GDP) is verified. The estimation of the model makes it possible to obtain the following results:

$$\ln(GDP)_{it=}5.385 + 0.6521 \ln(BA)_{it}+\varepsilon_{it} \quad (5.1)$$

This first estimate focuses on the relationship between economic growth and biological area, that is to say the effect of logarithmic economic growth on biological area in logarithm also using a model of panel data grouping Countries such as Tunisia, Morocco, Turkey, Italy, France, Spain, Algeria, Greece, Portugal, and Egypt. We tested the existence of a fixed or random effect, in this framework we were able to prove the existence of a random effect, we showed the significance of the two coefficients at 10% (because the capital gain Are less than 10%), indicating that the biological area has a significant effect on economic growth 65%. The overall significance of the model is indicated by the coefficient of determination R^2=0.76 which indicates a good fit of the model, i.e. the biological surface accounts for 76% of economic growth almost all. The Hausman test also proves the existence of random effects.

2nd pillar: The first step consists in estimating the following linear relation:

$$\ln(ME)_{it=}\alpha_0+\alpha_1 \ln(BA)_{it}+\varepsilon_{it} \quad (5.2)$$

Where α_0 constant and ε_{it} the error term (Table 1).

The estimation of this equation makes it possible to determine whether the relationship between CO_2 emissions and the biological area is verified. This estimation of the model makes it possible to obtain the following results (Table 2):

$$\ln(ME)_{it=}4.015+0.081\ln(BA)_{it}+\varepsilon_{it}$$

In the second pillar, we have two models. In the first one, we need to explain the emission of methane depending on the biological area. Various tests are associated with the estimation method: the specification or homogeneity tests, which correspond to the three Fischer tests, which account for the overall significance of the specific effects introduced and the Hausman test, which makes it possible to choose between fixed specific effects and random specific effects. The overall significance of the model is indicated by R^2=0.70, which indicates a good fit of the model, i.e. the biological surface explains (70%) the emission of methane. The Hausman test also proves the existence of random effects.

2nd step is to estimate the following linear relationship

$$\ln(WR)_{it=}4.015+0.081\ln(BA)_{it}+\varepsilon_{it} \quad (5.3)$$

Where α_0 constant and $\mathcal{E}_{it}$ the error term

The estimation of this equation makes it possible to determine whether the relation between the water retreat and the biological area is verified. This estimation of the model makes it possible to obtain the following results (Table 3):

Variable	Coefficient	Capital gain
α_0	5.385	0.001
α_1	0.6521	0.002

Table 1: Results of the estimation of eqn. (1) by the DLS.

Variable	Coefficient	Capital gain
α_0	4.015	0.01
α_1	0.081	0.00

Table 2: Results of the estimation of eqn. (2.1) by the DLS.

Variable	Coefficient	Capital gain
α_0	-1.324	0.001
α_1	3.254	0.03

Table 3: Results of the estimation of eqn. (2.2) by the DLS.

$\ln(WR)_{it=}(-1.324)+3.254\ln(BA)_{it}+\varepsilon_{it}$

Concerning this model, one wants to explain the retreat of water through the organic farming and in particular the biological surface. The constant is significant and negative. Here, the biological surface explains well the water retreat 3.254.

Concerning the adjustment coefficient $R^2=0.73$, this indicates a good fit of the model, that is to say that the biological surface explains well 73% the retreat of water. The existence of a random effect is proved through the nullity of the constant of the fixed effect.

By comparing the two models of the second pillar, we note that R^2 of the second model is larger than that of the first one, it is also noted that the aplha1 coefficient is higher in the second model (3.25) than that of the first one (0.73). This shows that the retreat of water explains better organic farming than that of the emission of methane.

3rd pillar: access to the study of the effects of organic agriculture on social equity as measured by health expenditure (HE) and employment in agriculture (EA).

The first step is to estimate the following linear relationship

$$\ln(SD)_{it=}\alpha_0+\alpha_1\ln(BA)_{it}+\varepsilon_{it} \quad (6.1)$$

Where α_0 constant and ε_{it} the error term, the estimation of this equation makes it possible to determine whether the relationship between health expenditure and biological area is verified. This estimation of the model makes it possible to obtain the following results (Table 4):

$$\ln(DS)_{it=}0.785+0.536\ln(BA)_{it}+\varepsilon_{it} \quad (6.2)$$

In the third pillar, there are two models. In the first one, we want to explain organic farming in terms of social equity. Various tests are associated with the estimation method: the specification or homogeneity tests, which correspond to the three Fischer tests, which account for the overall significance of the specific effects introduced and the Hausman test, which makes it possible to choose between fixed specific effects and random specific effects. In this case, we have also proved the existence of random effects and no fixed effects through the nullity of the constant of the fixed effect model. In this model, it can be seen that organic farming explains well the health expenditure $\alpha_1=0.536$ is positive and significant. The adjustment coefficient $R^2=0.72$ is greater than 0.5, indicating that the model is well adjusted. So the biological area explains well (72%) the health expenditure.

It remains to choose the model estimation method (6.1). The estimation of a random effects model in our case is rejected; the application of the Hausman test shows that the fixed effects model which ensures the homogeneity of the specific effects seems to be the most appropriate for studying the equation of the model studied. The adjusted coefficient of determination is high in all regressions. The fixed effects are therefore globally significant and explain a significant part of the dependent variables and the quality of fit of the model is better.

The second step is to estimate the following linear relationship

$$\ln(EA)_{it}=\alpha_0+{}_1\ln(BA)_{it}+\varepsilon_{it} \quad (6.3)$$

Variable	Coefficient	Capital gain
α_0	0.785	0.002
α_1	0.536	0.04

Table 4: Results of the estimation of eqn. (3.1) by the DLS.

Variable	Coefficient	Capital gain
β_0	2.069	0.05
β_1	-0.972	0.02

Table 5: Results of the estimation of eqn. (3.2) by the DLS.

Where α_0 constant and ε_{it} the error term, the estimation of this equation makes it possible to determine whether the relationship between agricultural employment and the biological area is verified. This estimation of the model makes it possible to obtain the following results (Table 5):

$\ln(EA)_{it}=2.069+(-0.972)\ln(BA)_{it}+\varepsilon_{it}$

In the second model of the third pillar, it is noted that following the DMC's estimate of the negative effect of organic agriculture on employment in agriculture, this is indicated by the coefficient (Beta1=-0.972) is almost zero. The adjustment coefficient $R^2=0.67$: is greater than 0.5, indicating a good fit of the estimated model. So the biological area explains well (67%) employment in agriculture. The existence of a random effect is proved through the nullity of the constant of the fixed effect.

By comparing the two models of the third pillar, we note that R^2 of the first model (health expenditure) is greater than that of the second model (employment in agriculture), it is also noted that the coefficient β_1 is negative and α_1 is positive. This shows us that organic agriculture has a negative effect on employment in agriculture than health spending.

According to these results, organic farming has a positive impact on economic growth (GDP), on the environment in these two components water retreat and methane emission and health expenditure. Except for employment or organic farming has a negative impact on employment.

In conclusion, we can say that the empirical results in this research validate the possibility of a positive link between organic farming and the three main pillars of sustainable development. The relationship between the biological area and its explanatory elements is well established.

There are limits to the econometric results. This is due, on the one hand, to the data because of the unavailability of organic farming data since this is a new area (organic farming is measured by biological area and not by total export biological, or total biological production, since only the data banks (FAO, World Bank) have found the volume or value of export or production by product). On the other hand, the data are derived from which may affect their homogeneity and reliability.

In this respect, we can see that conversion to organic farming is a winning strategy.

Conclusion

Organic farming is one of the most well-known modes of sustainable agricultural production by the consumer. It is presented as the "miracle solution" that helps produce healthy food for consumers, recovers soils that have been damaged with chemical fertilizers, and eventually save the planet. Taking into account the economic, environmental and social functions that must be fulfilled by any mode of healthy agricultural production, organic farming is extremely efficient. Producers must be supervised at all levels in order to be able to transit to organic farming in particular. They must be organized as a cooperative, supported technically and financially, trained in organic farming techniques and protected by the government.

Although organic farming contributes to sustainable development and the transition to organic farming is very beneficial, especially for developing countries, there are limits that remain and that they may be exceeded in subsequent studies:

- Organic farming is often perceived as a mode of production which is perhaps non-polluting and creates healthy and tasty products, but whose low productivity prevents any serious development in the future. This criticism yield is often expressed with the inability of Organic Farming to feed the world's population.

-The high prices of products from organic farming compared to products from conventional agriculture is the major obstacle to purchase because the food share of the budget of an average citizen can easily bear a slight increase compared to other parts that have greatly increased in recent years compared to food. However, behind this price, there are differences between a biological and conventional product: "the price that we do not want to see, that which is revealed in the medium and long term, the price of health that declines and the price of the degradation of the environment ".

Despite the barriers to organic conversion, government motivation and the gradual awareness of producers and consumers are well on their way to unlocking them, even though this will probably take time. The stakes are enormous, but all of us can act for a better future.

From this study emerge several avenues of reflection allowing continuing the analysis begun. For example, the following questions could be the subject of further research: Can organic agriculture nourish humanity? Can this transition to organic farming take land out of food production and further aggravate the problem of hunger in the world?

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