

# Reswitching of Techniques in the Modern Agriculture: a Theoretical Background

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**Abstract.** The industrialization of the agricultural sector has resolved, at least in Europe, United States and Japan, the thousand year-old problem of the lack of food. Unfortunately, during the last years the environmental limits of such an agriculture clearly exploded. Through our contribution we define the concepts of traditional and modernized styles of farming. We also hypothesize three future scenarios for modernized agriculture. We shall study in particular the "return of techniques" scenario that foresees the conversion to sustainability through the return of traditional techniques. In order to analyze this scenario, we shall introduce the Sraffian framework of the "reswitching of techniques" from the neo-ricardian theory (Sraffa 1960). Sraffa, within the "reswitching" framework, pointed out that a low-capital-intensive technique may be competitive both at a relatively low and high rate of profit. Finally, we shall show that, at least theoretically, it is possible that traditional agricultural techniques could be convenient in a context of both low and high profit level.

**Keyword:** styles of farming, modern agriculture, traditional agriculture, reswitching of techniques

## 1. Introduction

As is commonly known, economic development has determined a sequence of different societies: the rural one before, the industrial one later and the post-modern one today. Those different societies were modified according to the dominant economic sector (in temporal order: agricultural, industrial and tertiary sectors). The social transformations, produced by the passage from a dominant sector to another one do not concern only production and exchange relations, but the whole society: personal relationships, languages, shared values, aesthetics, *etc.* The centrality of an economic sector is therefore evident in its ability to transform and to make itself similar to its surroundings. When the modernization of the whole society took place, the agricultural sector, although fundamentally different from the industrial one, gradually managed to assimilate its principal resources and values.

The agricultural modernization model is based on characteristics that belong to the industrial sector: concentration, intensification and specialization (Arnalte *et al.* 2006). At the same time, the agricultural sector has substantially become dependent on modern inputs, external elements and industrial values.

The evaluation of the positive aspects of the modernization of the agricultural sector is a fairly controversial one. We cannot disregard that it has resolved, at least in Europe, in the United States and in Japan, the thousand year-old problem of the lack of food and the reality of

famines. Moreover, the modernization of the agricultural sector has also created a huge agricultural *surplus*.

However, during the last decades the limits of such an agriculture clearly exploded and the modernization model of agriculture has therefore met a crisis point. It produces, in fact, negative externalities, *i.e.* pollution or biodiversity losses. At the same time, modernized agriculture does not assure food safety. This has been proven by a succession of food crisis in the last 20 years (*i.e.* BSE).

The modernized agriculture, despite its overproduction and negative externalities, is particularly supported by EU and US agricultural policies. It is well known that in EU more than  $\frac{3}{4}$  of CAP support goes to the biggest 10% of significant beneficiaries of subsidy recipients. In US the distribution model is even more distorted: only 40% of farmers receive any subsidy. Within this group, the richest 5% get over half (UNDP 2005).

It is evident that farmers, in view of the CAP distortions, produce more than required by citizens. The overproduction could be destroyed (with a further waste of energy) or undersold on the international market with unfair dumping policies. The European citizens, instead, pay twice the agricultural support: as contributors and as consumers (CAP causes the increase of consumption prices).

Through our contribution we discuss about traditional and modernized styles of farming. We shall focus the discussion on the modernized agriculture. For this reason we shall hypothesize three future scenarios for modernized agriculture and we shall study in particular the one that foresees the conversion to sustainability through the return of traditional elements and techniques. Finally, we shall introduce the theoretical framework of the "re-switching of techniques" from the *neo-ricardian* theory (Sraffa 1960).

## **2. Modern and traditional styles of farming**

The processes of modernization have not been uniformly distributed among all the agricultural areas and some typologies of agriculture have remained excluded from modernization. That is because the traditional typologies of agriculture do not accept exogenous/industrial elements (*i.e.* mountainous agriculture where mechanization is applied with low efficiency /effectiveness).

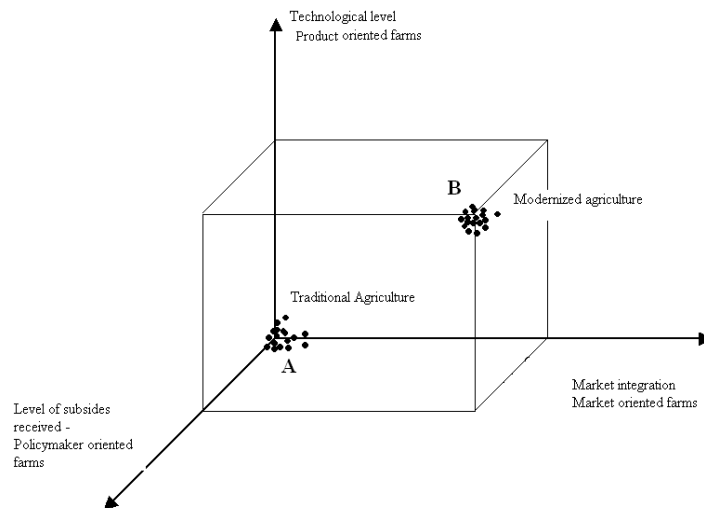
We can schematically identify two typologies of agriculture: the modernized and the traditional agriculture. The first one is characterized by agricultural techniques of production pervaded by industrial elements and values. It is based on the most fertile soils of the European rural areas. The modernized agriculture has also reached elevated levels of productivity but it lacks in socio-environmental terms (*i.e.* biodiversity losses).

Typologies of farms, both modernized and traditional, are extremely diversified and they are characterized from several "local styles of farming" (van der Ploeg 1992). The styles of farming depend on, in our opinion, different combinations of three elements: a) the technological level ("*product oriented*" farms); b) the high integrations with national or global markets ("*market oriented*" farms); c) the attitude to follow the public policies to catch greater government supports ("*policymakers oriented*" farms).

Modernized styles of farming are characterized by an elevated technological level and by a strong integration with domestic and international markets. The modernized farms result also strongly *policymakers oriented*. This is shown, for example, by the interest of such farms for corn and other grain crops that are hardly supported by the CAP.

In the Fig. 1 is schematized, in a three-dimensional graph, the styles of farming for the two types of agriculture. Modernized farms cover a cloud of points around the point B (Fig. 1) where the level of both technology and market integration is high and there is a great attitude to follow the policymaker choices.

Traditional styles of farming, instead, cover a cloud of points around the point A. For an example of this typology of agriculture we can analyze the extraordinary case of Italian self-consumption farms. In Italy, according with the last agricultural census, there are 1 million of self-consumption farms on the total one of the 2.5 million of farms (Massoli 2004). This typology of style of farming is characterized by a limited access to the domestic markets and by a very low level of technology. Their decisions are rarely policymaker oriented. The position of such farms in the Fig. 1 is presumably closed to the point A.



*Fig. 1 Traditional and modernized styles of farming*

### 3. Which future for the modernized agriculture?

In this section we examine three probable future scenarios for modernized agriculture. We connect them to one of the definitions of sustainable development which are present in the economic literature (Tab. 1). The definition we choose foresees a level of both strong sustainability (eco-centered development) and weak sustainability (techno-centered development), as well as endless intermediary levels. Each level is defined by different assumptions as to the replaceability level between the natural capital and the artificial material and immaterial capital (Turner *et al.* 1996 p. 75, Sortino 2007).

A) The first future scenario concerns the “continuing modernization”. Agriculture which is already modernized, through the further incorporation of innovative material and immaterial capital (i.e. new technologies, GMO and scientific knowledge), crosses over to a system which is based on a further specialization and an intensification of agricultural processes. Such a scenario is strongly supported by the agricultural lobbies and particularly by the agro-industry system. The agro-industry system is a very involved one. In fact, it receives low-cost commodities from farmers and it sells them the innovative technology (Van der Ploeg 2006). This scenario does not contemplate the reduction of externalities. This could guarantee the increase in technical efficiency and the economic growth of the agricultural sector, but not the rural development.

B) The second future scenario concerns the "balanced modernization". It is characterized by the prosecution of the modernization processes. This is emphasized by the introduction of innovative technology which is useful in order to decrease the negative externalities and to transform them into resources. Such a scenario fits into the paradigm of the weak sustainable development (or techno-centered development). The most evident example is the case of *biogas* production from animal wastes. It consists of the conversion of externalities (animal wastes) into an energetic resource.

C) The last scenario which has been hypothesized is mostly discussed in this paper because we believe that it is the most appropriate to represent the (European) model of multifunctional agriculture, which should be based on both production (*i.e.* safe food or landscape) and reproduction (of fertility or biodiversity).

We have called it the "return of techniques". It implicates the conversion towards the sustainability of the productive activities in agriculture through the return of virtuous elements, techniques and knowledge of the tradition. The traditional elements are suitably readapted to the new productive context.

The "return of techniques" scenario could be inserted in a theoretical context of strong sustainable development (or eco-centered development) which is connected to production de-growth. Obviously, the quantitative de-growth is not always linked with worse economic performances. In fact, products from *tradition* generally have, in post-industrial economies, more elevated prices. Therefore, within this context of rural development that is without quantitative growth the term "post-productivism" is the perfect synonym of "post-industrial".

*Table 1 Future scenarios of modernized agriculture*

<b>Future of modernized agriculture</b>	<b>Sustainability of development</b>
Continuing modernization	Economic growth without rural development
Balanced modernization	Techno-centered development
Return of techniques	Eco-centered development, quantitative de-growth

For a clearer presentation we have considered the three future scenarios of modernized agriculture as though they were clearly distinguished. Realistically speaking, we can find typologies of agriculture where modern unsustainable elements, modern sustainable elements and virtuous elements of the past are contemporarily present but with a different intensity that above-all characterizes a background tendency for rural development.

#### **4. Causes of return of traditional techniques**

The causes that force modernized agriculture to return to the past are linked to several causes. Such causes concern: A) the new consumption models; B) the new agricultural policies and, last but not least, C) the trend of the costs related to modern inputs.

A) *The increase in the incidence of quality food products on the demand (consumptions) and supply.* At higher levels of *per capita* income, which can now be found in post-industrial countries, such quality consumption in fact can be found in a greater hierarchical level within the demand structure. But we cannot disregard other two causes that have influenced the new food consumption models in the post-industrial countries: 1) the increase in education level; 2) the precautionary principle adopted by consumers because of the food crisis during the last decades.

We observe the tendency to emphasize a return to products from the "past" through an adaptation in terms of the certified quality of geographical origin or genuineness and

salubriousness of the products themselves. Some examples can be found in *GMO-free* or organic products, or in raw materials which are derived from autochthonous or abandoned varieties such as "*Farro*" (*Triticum turgidum dicoccum*, *T. spelta*). Some of these products recall a more remarkable return to a "past" which has been deemed to be virtuous whereas other products are merely the result of a marketing strategy. In this last case we list products of the big-scale agro-industries which entice the consumer into thinking about an idyllic vision of the rural world even if they apply modern productive methods (Fig. 2). Anyhow, the genuine return to traditional products can face several obstacles in particular *vis-à-vis* the health legislation. This does not always take into account traditional products in the furrow of food safety in the (post) modern sense of the word.



**Figure 2. Return of techniques as a marketing strategy**

*B) Changes which have occurred within the CAP.* Since its origins, EU agricultural policies have tried to direct the agricultural sector towards a technological expansion and also towards a total modernization. This policy caused an over-production of some basic agricultural products and an increase of negative externalities.

The first timid steps of the EU agricultural policies towards the environmental sustainability of productive processes started at the beginning of the 90s in the last century following specific agro-environmental measures (the reg. EEC 2078/92 gave monetary incentives for the return to past elements, such as the reintroduction of domestic breeds under threat of extinction or the restoration of hedges, wood spot and dry walls, *etc.*). The attempt to encourage virtuosity continues to this day through the "politics of rural development" which have been financed by the second pillar of the CAP and which uses a strategy of development in favour of rural territories.

The "politics of rural development" are matched with the "politics of cohesion" (Piomponi *et al* 2006). The politics of cohesion deal with rural territories but are based in a non-agricultural context (*i.e.* interventions in favour of transportation or environment) or in a local development context (*i.e.* the integrated territorial programs) (Piomponi *et al.* 2006). These policies draw inspiration from the so-called "Lisbon strategy" (2000) which was then confirmed by Goteborg (2001) and from the "medium-term revision" of the CAP (2005). They are both in the implementation phase for the 2007-13 period. Financing for uncoupled or coupled aid to production should be gradually reduced after 2013 and reutilized in the form of benefits for rural development. We will therefore notice a passage of resources from the first to the second pillar of EU policies.

*C) The increase in the cost of modern productive factors.* This has caused the so-called *agricultural squeeze* phenomenon (the compression of agricultural profits). This phenomenon consists in the reduction of the difference between the value of production and the production

costs (Arnalte *et al.* 2006, van der Ploeg 2006). This is also caused by the increase of energetic costs which has progressively augmented commencing with the 1973-75 oil crisis of the last century. In the 1991-2005 period a strong compression of the profits was created in Italian agriculture as the index number of output prices went from 100 (1991) to 111.8 (2005) whereas input prices reached 139.5 in 2005. The profitability loss of Italian agriculture has suffered an acceleration in the last five-year period (2001-2005) with respect to the preceding decade (1991-2000). The range between the index numbers related to the output and the input has been respectively 14 and 20 points in favour of inputs (Ciaccia *et al.* 2006).

According to our thesis, the joint action of these three causes is determining the partial conversion towards the sustainability of the productive activities of modernized agriculture through the return of techniques which were once considered to be obsolete.

## 5. Return of traditional techniques: searching for an economic framework

The attempt to frame the return of techniques within economic science has allowed us to analyze the framework of "*re-switching of techniques*" (Sraffa 1960). We believe that this framework has an important heuristic potential in explaining the processes of re-conversion of modernized agriculture through the return to sustainable elements of the past. Within this *framework* Sraffa tries to disprove the validity of the marginalist approach in the explanation of some anomalous phenomenon regarding capital and production (Marzano 1975). "Sraffa pointed out that the production techniques that are chosen as the most profitable ones, as variations take place in income distribution between profits and wages, do not follow each other in an unambiguous and unchanging order. (Pasinetti, 2000).

In fact, "[...]production techniques that require a high proportion of capital to labour at a low rate of profits may well be discarded by other (more profitable) techniques when the rate of profits is higher. But the former production techniques may once again become the most profitable techniques at even higher rates of profit. Known as the *re-switching of techniques*" (Pasinetti 2000). The intensity of capital is not therefore inversely proportional to the level of the profit rate (as marginalist economists assume).

In brief, Sraffa demonstrated (Fig. 3) that a production technique may be competitive both at a relatively low and high rate of profit, but may be dominated by another technique for intermediary rates of profit. It is not reasonable, as the marginalist economists affirm, that any change of technique as the rate of profit falls will be in favor of the more capital-intensive (or mechanized) one (Roncaglia 2003). Therefore, more mechanized techniques follow less mechanized techniques (and vice versa) in an unforeseeable way and without any relationship with the rate of profit. Even if in one of the switching point between the two techniques the system follows the marginalist theory, it is sure that in the other switching point the system will move in the opposite way (Roncaglia 2003).

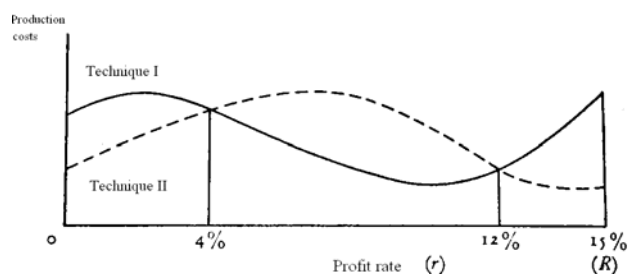


Figure 3. Re-switching of techniques



In accord with the Sraffian model we can hypothesize that, at least theoretically, the traditional agricultural techniques can return to be convenient in the modernized agriculture for the expectation to get bigger profits. Such affinity is evident in the Fig. 3; we could in fact hypothesize that within a low level of capital productivity -it is the case of traditional contexts- ( $r < 4\%$ ) a traditional technique (*i.e.* crop rotation) is convenient. The traditional technique is also convenient at higher level of capital productivity ( $r > 12\%$ ); while in correspondence of intermediary levels of capital productivity ( $4\% < r < 12\%$ ) the modern techniques are more convenient.

This is quite connected by the reality, for example practices of organic/sustainable agriculture may be convenient both in less favored agricultural contexts (mountainous areas etc.) and in potentially more favored contexts. Traditional techniques that return in the modernized agriculture are, however, adapted in the new (and modern) productive context. The organic agriculture in the less favored areas will be, for example, often informal and not always certified. The organic agriculture in the modernized areas gets, instead, strong inputs from the tertiary sector for the services of certification and *marketing*.

### Some concluding remarks for the debate

Generally speaking, our opinion is that the continuing modernization of the agriculture may not have a long term economic and environmental sustainability. The return of traditional techniques may help the modernized agriculture to find the "lost virtuosity" and the environmental sustainability.

In order to analyze the problem, we have introduced the Sraffian framework of "re-switching of techniques" (Sraffa 1960). Finally, we have demonstrated that, at least theoretically, traditional and sustainable techniques could be convenient in a context of both low and high profit level.

*We would like to acknowledge the following contributions: Sortino: §2, §4; Sortino and Chang Ting Fa: §1, §3, §5 and the introduction.*

*This paper belongs to the research project: Microfilieri di qualità funded by the Friuli Venezia-Giulia Region.*

### References

1. Arnalte, E. and D. Ortiz, 2006. *Tendenze dell'agricoltura spagnola. Difficoltà di attuazione di un modello di sviluppo rurale basato sulla multifunzionalità in agricoltura*. In: Cavazzani A., *Politiche, Governance e Innovazione per le aree rurali*, INEA, Edizioni Scientifiche Italiane, Napoli.
2. Ciaccia D. and R. Finuola, 2006. *Il sistema agroalimentare italiano 2005*, in INEA, *Rapporto sullo stato dell'agricoltura italiana*, Roma.
3. Marzano, F. 1975. *Problemi relativi alla definizione del capitale*. In: Istat, *Annali di statistica, Serie VIII, n. 28*, Roma.
4. Massoli B., 2004. *Le aziende autoconsumistiche in Italia*. Conference: *Bioregionalismo e Benessere: alla ricerca di una nuova sinergia ecologica e alimentare tra etica e utopia*. *Attese dei consumatori, aggiustamenti produttivi e esternalità*, Udine, Italy, November 4-5.
5. Pasinetti L., 2000. *Critica della teoria neoclassica della crescita e della distribuzione*, "Moneta e Credito", n. 210.
6. Piomponi M., R. Finuola, L. Briamonte, S. Vaccai and A. Cristofaro, 2006. *Principali eventi di politica agraria*. in INEA, *Rapporto sullo stato dell'agricoltura italiana*, Roma.
7. Roncaglia A. 2003. *La macroeconomia dopo Sraffa*. *International conference Piero Sraffa*, Accademia nazionale dei Lincei, Roma.

8. Sortino, A., 2007. *L'inquadramento teorico del paradigma dello sviluppo rurale endogeno*. In: *Agribusiness Paesaggio & Ambiente*, Vol. 10, n. 2.
9. Sortino, A., M. Chang Ting Fa, L. C. Piccinini 2008. *The future of modernized agriculture and the return of traditional techniques*. MACE Conference, Berlin, Germany, January.
10. Sraffa, P., 1960. *Production of commodities by means of commodities, prelude to a critique of economic theory*. Cambridge University Press.
11. Turner, R. K., D.W. Pearce and I. Bateman, 1996. *Economia ambientale*, il Mulino, Bologna.
12. UNDP, 2005. *Rapporto sullo sviluppo umano*, UNDP, Roma.
13. van der Ploeg, J.D., 1992. *Dynamics and mechanisms of endogenous development: an introduction to the theme of the seminar*, in *Options Méditerranéennes, sér. A./n.23 - Strengthening endogenous development patterns in European agriculture*, Camar, Crete, October 20-22.
14. van der Ploeg, J.D., 2006. *Oltre la modernizzazione, processi di sviluppo rurale in Europa*. Rubettino, Catanzaro.