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Economic issues and perspectives on innovation in new resistant grapevine varieties in France

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Abstract

The arrival in France of new varieties resistant to downy mildew and powdery mildew calls into question the aims of this "revolution" in a sector dominated by tradition. The proposed evaluation reviews the historical experience of cross-breeding programmes from an evolutionist standpoint before analysing the responses to the new technological paradigm of resistance to disease. Taking account of the time periods, dating their implementation and describing the opportunities open to winemakers, the paper revisits the scientific controversies, the institutional blockages to be eliminated, the means of recognition and the prospects.

Keywords: Innovation; Grapevine varieties; Environmental compliance

1. Introduction

Varietal innovation has long contributed to agricultural progress. An excellent example of this can be found in the winemaking sector, with the solutions provided by new hybrid varieties, both direct producers and rootstock, to the phylloxera crisis in the 19th century. In France, after the Second World War, plant breeding became the exclusive domain of public research. Launched in 1956, the programmes yielded some limited results, but their experience can be of use in analysing new programmes.

The major innovation of the past 15 years lies in the fact that varietal innovation is much more blatantly "pulled by technological demand" (demand pull) than pushed by supply (technology push). The choices of technological paradigms have not been the same in France as in the rest of Europe, and in particular Germany, Switzerland and Italy. The socio-economic evaluation of this major technological innovation is therefore based on understanding past technological trajectories as well as analysing the current technological supply, strategies adopted by stakeholders', including the value chain's pilot institutions, market characteristics and the qualitative foundations underpinning their definitions.

2. The evolutionist baseline and the innovation chain

The standard neoclassical approach is of no great help in understanding the technological dynamics. Consequently, we use the tools of evolutionist theory together with the systemic analysis of the innovation chains and the product chains.

The aim of evolutionist models is to explain how firms and their technology have developed over time and how the agent or process studied achieved this. The explanation includes random elements which renew or generate variations of the variables studied to which are added sorting and selection mechanisms. In the social sphere, these models comprise imperfect processes of learning and discovering by trial and error together with selection mechanisms. These models specify the determinants of adaptation (or fitness), thereby

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requiring the determination of the selection unit and the main mechanisms by which selection is made.

We revisit Giovani Dosi's two fundamental concepts: the technological paradigm and the technological trajectory. The technological paradigm represents what we are looking for, how, why and who conducts the research. The technological trajectory provides the economic dimension of the technological paradigm by combining the research programme and its economic evaluation by different stakeholders including firms, sectors or industry, the market, development agencies and economic policy makers.

The idea behind calling on Dosi's concepts is thus to invite the researcher studying a group of companies and a specific technology to explore the existence and describe the nature of this orientation. In a systemic and finalised approach, the complementary notion of innovation chain makes it possible to identify the stakeholders participating in a sector-based technological trajectory.

To understand the aims of this innovation, we conducted numerous interviews with French and foreign researchers involved in the development of this technological paradigm as well as the different institutions concerned at the stage of development.

3. A little history

From a historical standpoint, innovation in wine-growing plant material has focussed much more on sanitary and clonal selection from 1962 than plant breeding. This line of research has transformed the value chain by eradicating the main viral diseases and thus supplying the entire world with plants boasting unparalleled levels of productivity and quality. The new varieties produced by the cross-breeding programmes launched in 1956, at least in France, did not have this impact. From 1974, for the pioneering work of Alain Bouquet, and from the beginning of the new millennium for French viticulture research, the increasing demand of society for sustainable development and a reduction in the use of pesticides renewed the technological paradigms of plant breeding along with the attention paid by policy-makers and researchers to this road to progress that had been almost completely abandoned in France.

4. Social demand

Until recently, the range of pesticides available (fungicides and insecticides) ensured that winemakers enjoyed a high-quality harvest while protecting yields. It is only relatively recently that the wine-making sector has become aware of the need to reduce the use of pesticides. Winemakers and their workers have often been unaware of the risks to their health. The 2001 ban on the use of sodium arsenite (a carcinogenic product) in the wine-making sector to treat the main vine trunk disease (Esca) only served to confirm the general criticisms levelled at pesticides by ecologists. There were also some complaints relayed by the press with regard to a slight intoxication suffered by schoolchildren when the product was sprayed near their school. The data concerning the proportion of pesticides used by the wine-making sector in Europe have also heaped further disgrace on the sector.

The Ministry of Agriculture launched the Ecophyto 2018 plan with a view to satisfying this social demand, requiring a commitment from the stakeholders to reduce the use of pesticides across the country by 50%, if possible within a time frame of ten years. The fear of facing legal proceedings, as in the case of asbestos, for having failed to provide agricultural workers with sufficient protection against these risks further increased awareness within the sector, drawing operators' attention to all possible improvements in this sphere as well as the potential contributions of new resistant varieties. The reduced use of pesticides in the wine-making sector has therefore come to represent an essential social demand.

5. Plant breeding is a long process

In France in 1956, researchers at the INRA launched a plant breeding research programme. The aims of this programme were to create new varieties that were at least "equivalent" to existing varieties, in particular the predominant grape variety at that time, the Carignan, such that these varieties offered at least the same yield. Table wine yield was the main "cost divider", and thus a factor of income. The varieties had to be "grown upright", to avoid tying, and goblet-trained, a cheap pruning method broadly used in southern France. The grapes were to ripen earlier as in southern areas, the harvest took place two years out of five during or after the autumn rains, often leading to damage caused by grey mould (Botrytis cinerea). Furthermore, it would be a bonus if this variety were less susceptible to the most common diseases (downy mildew and powdery mildew). Finally, the organoleptic qualities were required to be equal too, if not better than, those demonstrated by the existing varieties.

The line of research adopted was that of intra-specific hybridisation. The main justification for this resulted from French legislation which had banned most inter-specific hybrid varieties resulting from post-phylloxera works producing wines deemed to be of insufficient quality. Furthermore, to emphasise this distinction, plant breeders described these varieties as "cross-breeds" and not hybrids.

This programme encountered variable success, but a series of new varieties appeared with differing dissemination rates. If we take the example of the Marselan, the original cross-breed (Cabernet × Grenache) was performed in 1961 with stage 2 comprising 12 seedlings reached in 1971 and stage 3 comprising 150 seedlings achieved in 1974. The micro-vinifications conducted from 1978 to 1982 recognised the high quality of this grape variety. Professional opinion was nevertheless negative, with the yield deemed too low. The INRA continued its experiments and succeeded in having the variety entered in the catalogue in 1991. Twenty-two years later, in 2013, this variety covers a surface area of 3,226 ha in Languedoc-Roussillon, representing 1.37% of the vineyards in this region. In 2013; the other four main varieties created exhibited dissemination rates of 0.93% (Caladoc), 0.21%

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