The Increasing Knowledge Intensity of the Modern Wine Industry
Challenges and Opportunities for Developing Countries

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Since the last quarter of the twentieth century, an intensive technological modernization process has gradually permeated the wine industry in all its phases. This process has become more pervasive since the wine industry started to operate on a global scale, and innovation, knowledge inputs and technological capacity have become key to success in an increasingly globalized market. In terms of R&D, three main pillars of wine science seem to have emerged: grape culture; wine production; and sensory analysis and marketing. Therefore, the knowledge and skills required to make quality wines have become increasingly complex and sophisticated, while modern winemaking, by drawing on different scientific fields, has become inter-disciplinary in nature. More specifically:

- Firstly, in order to master the determinants of wine quality, it has become essential to understand the physiology and genetics of the vine, while notions of microclimatology and soil physio-chemistry are key to explaining grape quality and vineyard yields.
- Secondly, the role of chemicals in the winery has progressively diminished, but that of physics has increased, with a view to understanding how presses can produce a clearer juice, how gravitational flows can better preserve the integrity of the liquids and how fine filtration technologies can improve wine structure.
- Thirdly, the knowledge of human sensory psycho-physiology has become essential for interpreting wine quality, while the possibility of testing the organoleptic qualities of wine with electronic devices has made possible a totally new, science-based type of quality assessment.

In this context, the present paper provides solid evidence of the increasing importance of both codified and tacit knowledge in the emergence of the modern concept of quality winemaking. It shows how the growth of the international wine trade, which has characterized the last quarter of the twentieth century, was mainly due to a group of new entrants — so-called “New World” producers — that managed to compete in a market dominated for centuries by established “Old World” producers, based on quality upgrading, R&D and the incorporation of sophisticated new machinery and equipment. It also explores the opportunities and challenges for the entry of developing countries into the modern wine industry. It argues that entry opportunities do exist - but for developing countries, taking advantage of them is increasingly difficult.

This paper is structured as follows: Section 1 illustrates how science has been brought in to solve problems of different nature both in the area of viticulture and in the area of viniculture, and how innovation of all sorts has permeated the wine industry in all its phases. Section 2 focuses on the key role of tacit, codified and capital-embodied knowledge in modern winemaking, as pillars of the so-called “wine revolution”. Section 3 examines the relationship between this revolution and the dramatic shift in international wine consumption patterns. Section 4 shows how the capacity to innovate was key to the ability of New World producers to become leading wine exporters, and how this translated into fast-growing world wine market shares. Section 5 illustrates show FDI flows, mergers and acquisitions (M&A), alliances, and joint-ventures have radically changed the structure of the world wine industry. Section 6 portrays the surprising entry of developing countries under these new circumstances. This is a surprising phenomenon since one would expect that the increasing knowledge intensity of the wine industry would make entry conditions for developing countries narrower with respect to the past. The solidity of the current position of developing countries as leading wine exporters actually opens up a series of interesting questions about the determinants of the export boom of their wine industries, their different performance over time, and the extent to which their increased exports have been characterized by increased quality, value-added and technological change, or have been confined to the low-end of the quality spectrum.