# Towards digital wine certification in Germany

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**Abstract:** We discuss the potential for digitizing wine certification in Germany.

**Keywords:** wine certification, wine testing, Germany, digital information technology, analytic methods

## 1 Introduction

Complex information technologies may comprise analog and digital elements and they often require mental activity by humans. Most often, once a digital technology element has penetrated a complex technology system many of the remaining analog components are eventually converted into digital too and the mental activities are modified. Examples of this conversion, which we call the "Shannon Touch", abound: maps became GIS/GPS, ledgers became spreadsheets, and so forth. We expect this phenomenon to convert wine certification in Germany from a mixed analog, digital, and mental process into one that is digital and modified mental.

## 2 Wine certification in Germany

Even though wines vary widely in their valuable traits, most are sold in tightly closed opaque bottles, thereby hiding their contents from the senses of potential buyers. This practice renders wine buying risky for buyers. The risk is reduced when symbolic information is substituted for the sensory experience. The symbols are usually printed on the labels on a bottle. Wine labels don't reduce buyers' risk by much unless buyers are assured of the veracity of the print on the label. Certification provides this assurance.

In Germany a wine certification system was introduced by law in 1971. The system is compulsory for all wines with a protected designation of origin (PDO). In Germany, PDO-wines are better known under their traditional names "QbA" and "Prädikatswein". Due to the involvement of state governments in wine certification there are inter-state differences in the details of the wine certification procedures. We focus our study on the certification system in Rheinland-Pfalz, the largest wine producing state in Germany.

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Despite the differences in details, all state certification systems rely on organoleptic assessment of the wines by an expert panel. The system is described in [Br16].

Wine certification involves four types of agents: (1) Bottlers ("Abfüller"), which include wine estates, cooperatives, and large wine bottling plants. (2) Accredited laboratories that datafy certain physical, chemical, and organoleptic properties of wines. (3) Wine test centers that are empowered by law to certify PDO-wines. (4) Wine test panels whose experts perform organoleptic tests and who rate the wines that undergo certification. Fig. 1 shows the activities and information flows that are generated for a wine during certification. In essence, the certification system does two things. It first datafies wine; it then decides on the basis of this data whether the wine meets the criteria of the quality category in which it is to be marketed. A wine that has been legally certified for a certain PDO-category is given an "Amtliche Prüfnummer" (A.P.-Nr.).

Most of the individual certification activities are rather mundane and involve processing forms and making routine decisions. Some of these processes have already been converted from analog to digital. Certification involves, however, several mental processes that are not easily converted into digital. This are, first, the mental processes that wine testers have to make when they appreciate a wine; the other comprise the final decisions by the director of the certification authority whether or not, and with what qualifications, a wine is granted an A.P.-Nr. The tasks of the wine testers are to assess the wine visually and to determine its odor. They taste the wine to determine whether it has any one of eleven wine faults, and they judge its typicality. Wine testers then have to rate the wine on a five point scale. Wines are tested in parallel by a panel of usually four testers. Typically, around sixty wines are tested per hour.

## 3 Prospects for digitizing the process

From an information perspective the job of wine testers is to datafy certain organoleptic attributes of wine. To this end, they taste it, judge it, and express their judgments as binary or ordinal numbers. We do not know in any detail how the wine testers do this. Fortunately, neuroenology sheds some light on wine tasting and testing [Sh15]. From the perspective of this new science tasting is an experience based on mental processes that receive information inputs from the eyes, the ears, and from a range of chemical and physical sensors located on the tongue, the cheek, the nose, and the nasopharynx. There is little prospect for substituting digital IT for the mental processes. The prospects for substituting or complementing the biological human sensors with analytic methods are, in contrast, much better. Relevant methods are gas chromatography, mass spectrometry, nuclear magnetic resonance spectroscopy, electronic noses, and electronic tongues [PHE08], [Ro14], [Sa12].

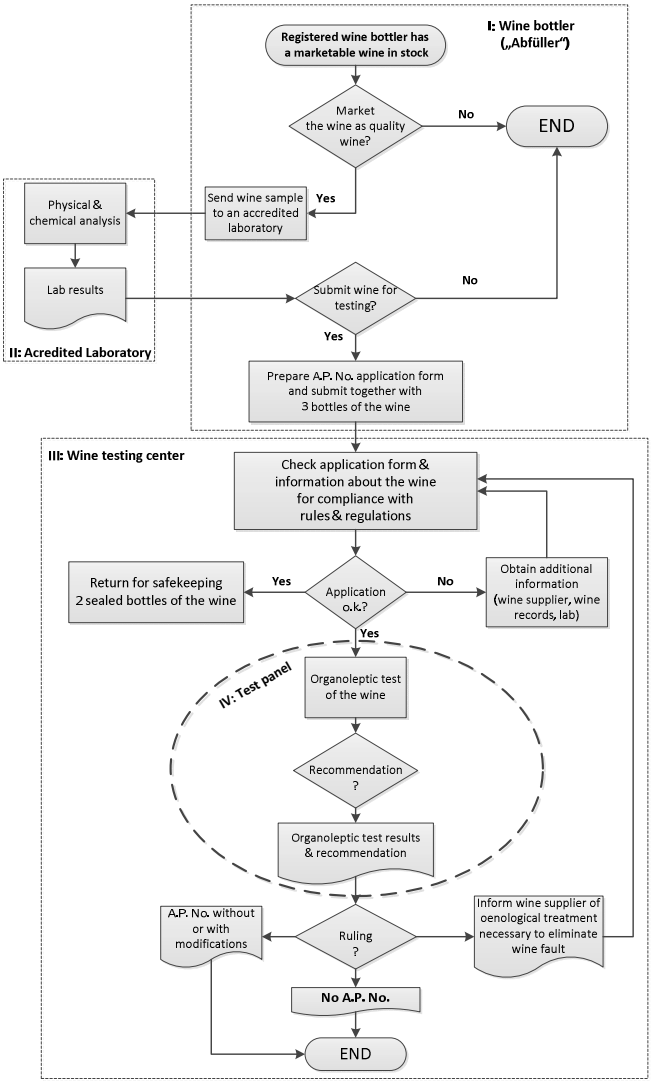


Fig. 1: Flowchart of the wine certification process

Essential components of the devices that perform the analyses have become digital. And once they were digital the devices have been subject to the important "laws" about the performance increase of digital IT: Moore's Law for processing capacity, Kryder's law for storage capacity, and Arthur's law about the complexity of digital devices. The laws, in combination with strong demand for mobile analytic devices by several industries, such as health, food, security, and environmental protection, have accelerated the evolution of analytic technology.

An example for this evolution is 1H nuclear magnetic resonance (1H NMR) spectroscopy. Commercial NMR systems for chemical analysis became available in the 1960s. First applications of the method to wine analysis were reported in the early 2000s. 1H NMR is now used for commercial fingerprinting of wines [Go13], [Pi15]. Such methods are well suited to complement and perhaps to substitute wine testers' skills for detecting wine faults. Whether they are also suitable to perform or complement the more difficult task of rating wines is, however, an open question. Nevertheless, 1H NMR analysis suggests that the "Shannon Touch" is about to affect wine certification.

## 4 Concluding remark

Innovation usually requires the availability of a new technology, entrepreneurship for its adoption, and, perhaps, some adaptation of laws and regulations. We have the technology for an innovative digital conversion of wine certification. Whether the conversion will be forthcoming will therefore depend on the supply of entrepreneurship and the adaption of some legal rules.

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