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Wine Economics and Policy 8 (2019) 165–170

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# Innovative solutions for the wine sector: The role of startups

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Received 18 March 2019; revised 7 August 2019; accepted 19 August 2019

Available online 23 August 2019

## Abstract

The economic globalisation has opened new pathways for commerce and triggered a logistical revolution, which in turn has produced enormous technological innovations. In this context, the role of startups is becoming increasingly crucial since they are positioning themselves as innovation enablers among large and small companies. Between these innovations, IoT, Big Data Analytics and Blockchain can be used in various domains, among which the logistics of the whole wine supply chain. Here we will consider some of the issues and needs that arise in this market sector, showing how Wenda – a startup born in Bologna in February 2015 that works to improve sustainability and traceability in Food & Beverage supply chains – has been able to leverage IoT, Big Data Analytics and Blockchain to empower the wine supply chain with solutions that enable wine traceability throughout the distribution and the after-buying-in preservation and commercialisation phases.

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**Keywords:** Wine; Innovations; Supply chain; IoT; Big data; Startups

## 1. Startups and the logistical revolution in the agrifood system

Starting from the 1950s, the logistical revolution has determined a general redefinition of regional and global supply chains (Grappi, 2016). The radical changes of productive processes, the large-scale diffusion of containers, the elaboration of software and algorithms, the intensification of digitalisation processes, the formation of new technologies and the IoT paradigm have all brought the world of logistics to play a key role in global economics and politics. In heterogeneous geographies and markets, the traceability of a specific product offers to the end-user the chance to gain full awareness about the product's origin and logistical journey.

Considering all these elements, it appears that global commerce actors - including players from the wine industry - tend to pursue the direction of supply chain traceability and

dissemination of technologies that enable a significant improvement of currently available services (Menghini and Fabbri, 2013). Against such background, keywords such as the Internet of Things (IoT), Big Data Analytics, Blockchain, Waste, Higher costs for shipments, Unchecked preservation conditions, Operational efficiency and Consumer care, can indeed contribute to shed light on the challenges of the logistical revolution in the AgriFood system and the role of startups.

**Internet of Things (IoT)** is “a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies”.<sup>1</sup> IoT describes both the proliferation of boundlessly connected devices able to acquire and communicate data and the virtual environment created by their interconnectedness.

<sup>1</sup> This definition has been given by the Internet of Things Global Standards Initiative, one of the Global Standards Initiatives by ITU – the UN specialised agency for information and communication technologies. <https://www.itu.int/en/ITU-T/gsi/iot/Pages/default.aspx> (the reference was last accessed on 02-08-2019).

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Peer review under responsibility of UniCeSV, University of Florence.

Every device can become smart (capable of self-identification, localisation, diagnostic, data acquisition and communication, processing, execution) and be connected through standard communications protocols.

In recent years, Big Data, that is “the totality of technologies and methodologies for the analysis of massive data, that indicates the ability to extrapolate, analyse and link huge, heterogeneous, structured and unstructured data, to discover the connection between different phenomena and predict their future occurrence” (De Mauro et al., 2016), have increasingly represented the new frontier of innovation fostered by Information Technology (I.T.).

The said capabilities are rapidly becoming a necessity for all companies (Davenport and Harris, 2007; Najafabadi et al., 2015). These companies, using **Big Data Analytics** (technologies and software implemented for the study and research of connections and relations between Big Data) can extract new information and contribute to creating new forms of value in all the stages of the supply chain. IoT and Big Data Analytics constitute very versatile technologies and can be used together in various domains (Sanders, 2016).

**Blockchain** is a distributed database that allows for registering, efficiently and in an unamendable way, transactions (of assets, money, data, etc.) between many parties, each having a copy of the “database” itself to validate the transactions. Blockchain's revolutionary component is its ability to allow communications or transactions between two parties without the need of a third party to certify them. While there are many areas of the application still unknown,<sup>2</sup> one of those concerns the adoption of Blockchain technology for transports and the Food & Beverage sector. For instance, a producer who liked to ensure supply chain traceability for her/his wine from the winery to the table, by uniting IoT and Blockchain, could monitor product integrity and put data in an unamendable ledger whose access would then be permitted to the client, who can thereby be sure of the product's handling during its whole lifetime.

These new technologies have allowed the digitalisation paradigm to intervene substantially in Food & Beverage tracking, reducing costs, pushing up revenues and making processes more efficient: thanks to digital solutions, 36% of agrifood companies have found a reduction in time and costs in relation to processes of data gathering, management and transmission. Benefits, these ones, coupled with data and information availability and the possibility to transfer value along the supply chain. Digital innovation enables greater sector competition, and startups play an increasingly central role in this dynamic since there are about 500 startups worldwide that offer digital solutions in the agrifood sector.

<sup>2</sup> Only recently Blockchain has been used for international trade deals, which so far involve U.S.A. and China. <http://bitcoinist.com/us-and-china-use-blockchain-to-trade-soybeans/> (the reference was last accessed on 02-08-2019).

<sup>3</sup> “FoodTech is an ecosystem made of all the agrifood entrepreneurs and startups (from production to distribution) innovating on the products, distribution, marketing or business model.” <https://www.digitalfoodlab.com/en/foodtech/>.

Another sign that the FoodTech<sup>3</sup> market is rising can be seen in the fact that in Italy alone there are currently 133 solutions dedicated to Food & Beverage traceability, adopted by 44% of the companies in the market, that have produced costs and time-saving (Smart AgriFood, 2018).

However, it is not all fun and games, since downsides are still significant: “Although some innovators are enthusiastic about IoT applications for optimisation and prediction, [...] most customers will remain focused on simple use cases, at least for the immediate future. And that means they will not obtain full value from the IoT” (Patel et al., 2017).

In fact, companies that work with wine tracking systems know quite well the reality of the market and its difficulties, which will be now briefly listed.

### 1.1. Waste

Due to recall campaigns or to the refusal of the product by customers because of poor preservation conditions, damage during shipment or failure to meet best practices at the stage of logistical handling of the wine.

### 1.2. Higher costs for shipments

Thanks to supply chain traceability costs can be lowered through data driven decisions. Today, the major problems regarding wine-chain actors are about logistical handling of the wine product: as it has been confirmed by Wenda's qualitative interviews and market surveys, the customer is never 100% sure that the product remains intact in the supply chain, that it does not exceed critical thresholds for its perfect preservation, that its trail does not go dead and that it is not forged. Furthermore, not knowing the shipment's integrity and the environmental conditions in its logistical junctions contributes to the increased possibilities of shelf-life reduction and subsequent recalls, nullifying the chance to predict and solve potential issues.

### 1.3. Unchecked preservation conditions

Very few players offer today specialised services of product transport and handling in controlled conditions. One can usually ask for tools or services of temperature control in shipment/storage phases, but this does not apply to other physical quantities as important as temperature for the ideal product preservation, such as humidity, sudden acceleration (and its subsequent shock) and light exposure. It is generally important to keep in mind that to ensure a proper traceability of the wine-chain and thus provide those are key information for customers' choices: the final customer has a right to know if her/his wine has been exposed to events that might have affected its qualitative properties (Czibulya et al., 2012).

### 1.4. Operational efficiency

If potential problems and inefficiencies of shipment management systems are unknown, then delays poor handling

coordination and other negative consequences can indeed occur. It also becomes harder to try to improve one's own supply chain due to the lack of objective data about operations.

1.5. Consumer care

Consumers are increasingly thirsty for information about anything regarding the product they buy. It emerges a scenario in which it appears that the average consumer is both more concerned by quality and more oriented to choose products and companies with which can build a relationship that leads to greater awareness – precisely because of supply chain traceability.

Bearing in mind the array of difficulties that could arise in the Food & Beverage tracking market, the attention shall now be turned to emerging technologies, whose potential can be harnessed to drive successful supply chains and distribution processes.

2. Wenda's services and solutions

On both national and international level, startups are increasingly shaping their own role as “problem solvers”, exploiting new technologies or business models while either merging their solutions with big companies into open innovation processes or creating stand-alone solutions and companies. Wenda was born in February 2015 in Bologna as a startup company pursuing innovation and flexibility in whatever it does and creates, with particular attention to sustainability in the Food & Beverage chain. The team is structured by mixing the experience of senior managers and engineers with more than 25 years old careers in the field of innovative

technologies with the modern vision and knowledge of young professionals born in the digital era who studied agribusiness. Through time and many efforts, Wenda has come up with different solutions to the various issues detected in the wine supply chain, it has diversified the targets by carefully analysing the needs of various stakeholders in the wine sector, and has created IoT and Big Data Analytics services and solutions tailored for those different needs.

2.1. Wine logistics: Wenda Information Management Hub

Wenda designed a solution involving IoT, Big Data Analytics and Blockchain technologies, that has the potential to bring wine at its best qualitative expression to final consumers and to empower the wine supply chain with a shared, affordable, plug-and-play platform to indicate the best possible decisions for managing travelling wine.

Wenda Information Management Hub is the only cross-supply chain and cross-device Food Integrity management hub, turning supply chain control from a cost to a competitive advantage (Fig. 1). It is a SaaS Web Platform that collects and analyses unstructured, scattered data from market-available data loggers employed across all stages of the wine supply chain. It delivers traceability, cold chain and integrity insights to the different players involved in the chain, boosting their collaboration. Wenda aims to facilitate operations and boost end-to-end supply chain visibility: data loggers are inserted into each box, pallet or container of any given shipment, to collect environmental data (geolocalisation, temperature, Food Integrity); data are sent to the web platform which aggregates, compares and processes them. The client can follow in real-

Turn the supply chain control from a cost center into a competitive advantage

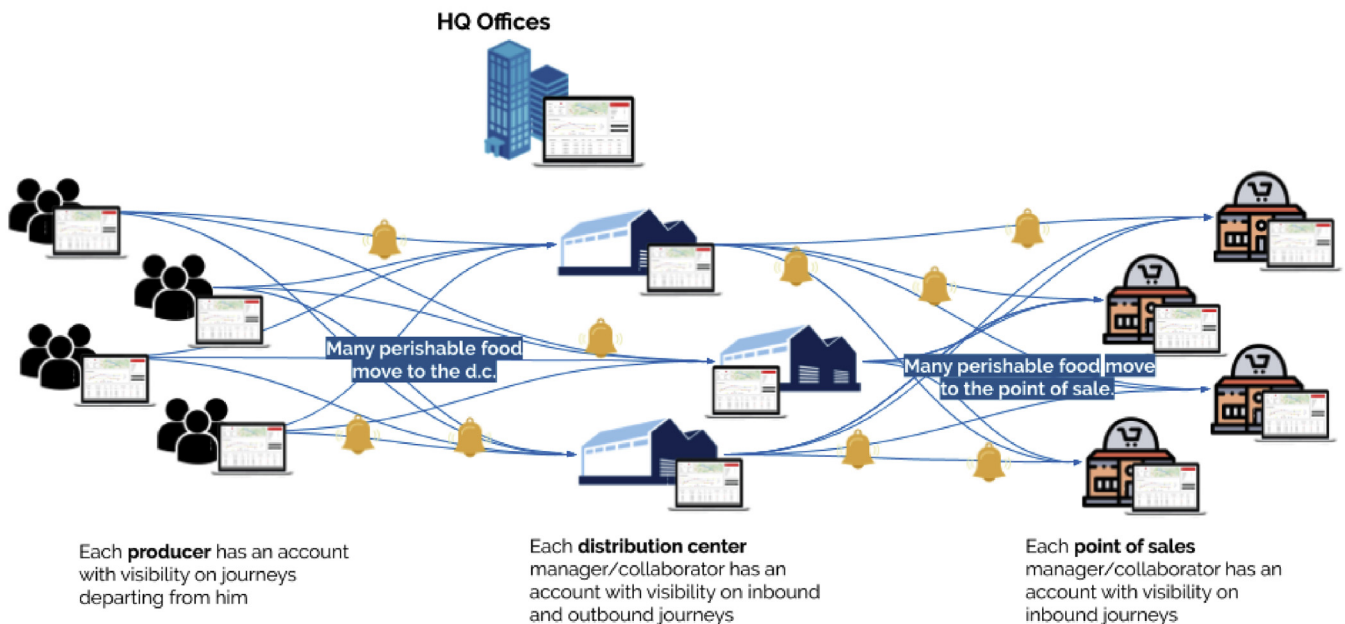


Fig. 1. Process of Wenda Information Management Hub (Source: Wenda internal files).

time and from a single control point the product's conditions, gaining knowledge of the hazard points in the supply chain, ensuring the best product care and enhancing internal processes. This advanced tracking applies not just to mere portions of the supply chain, but to all the different stages that constitute it. In this way, the client will always be aware of the product's geolocalisation and integrity.

Wenda Information Management Hub features integrity alarms and enables a supply chain hazard points overview, thanks to which one can find which are the main hazard points along the chain to optimise it and take the best care of the product, controlling everything from one single point. Differential access levels to journey data allow the client to share data real-time with her/his clients, logistics, quality and insurances departments, regulator agencies. A cloud wallet with Travel & Quality docs helps to harness the potential of Wenda's document-sharing capability for each shipment and storage, saving time and paper. Moreover, given that traceability systems and data-loggers are ever-changing, Wenda Information Management Hub provides integration with different tracking systems and data-loggers available on the market, so that the client can seamlessly integrate all of them into one single control point, to benefit the company's ERPs or Blockchain ledgers.

An upgrade of the system is currently funded by IoF2020, the European funding program for.

Internet of Food and Farm. This will bring technology upgrades and other advantages if compared with the former version. The project is called Beverage Integrity Tracking and will be fully developed within the end of 2020. So far, the **benefits for the wine sector** are the following:

- Wineries will **build up experience** on transportation conditions, in order to optimise future deliveries and market an almost perfect wine;
- Retailers can use the same system to **report any non-compliance of the received good**, and to send the producer first-hand feedbacks; they can also show consumers their care for the products they sell;
- The ensemble of data from all wineries that use the system will constitute a **general database on issues frequency** in wine shipping, open through a license to insurance companies, that can hence propose IoT-based insurance policies to the wine sector;
- The Blockchain environment can be used to implement **IoT-based insurance policies enabled by smart contracts**<sup>4</sup> that activate themselves if predetermined

conditions are met. Certifying data and information on Blockchain ledgers is a plus for anti-tampering purposes and trust-building: all the IoT data, after having been stored on the cloud platform, will be copied and certified on Blockchain ledgers such as Hyperledger or Ethereum, achieving complete robustness and protection.

Wenda Information Management Hub can be employed not only by the wine industry: it could also be quite empowering for all the Food & Beverage players whose supply chains are traversed by perishable or sensitive products.

## 2.2. Wine events: MEMORvINO – connecting wine people

Bearing in mind that wine logistics is just a portion, significant as it might be, of the whole wine sector, Wenda thought to work on market differentiation and subsequently designed **MEMORvINO**, a service based on a three-components architecture – MEMORvINO, MvApp, ODYN Platform – to support all the stakeholders involved in **wine-tasting events**, who are always looking for new modalities, contents and innovative proposals for attendees and exhibitors. MEMORvINO is meant to create a more involving and more **interactive relationship between wine producer and wine lover**, establishing a fil rouge between a physical and digital experience (Fig. 2).

A specific IoT device, MEMORvINO, is handed to producers and placed on their tasting tables. At the time of registration at the event's entrance, each attendee picks up a smart glass equipped with Near-Field Communication (NFC) technology built inside an electronic sticker, that identifies the owner's glass. Whenever the attendee will taste a wine, there will be an interaction between the smart glass and MEMORvINO: the information regarding the consumer and the wine he/she has tasted will be recorded in the IoT device and be transferred to ODYN platform via wireless. The platform will collect the data coming from the IoT device and will allow matching each wine lover to the wine he/she has tasted, thus being able to provide the right data sheet about the tasted wines and to know who tasted which wine.

Thus, MEMORvINO works differently depending on the different users: after the event, the platform makes information about available wines and people who tasted them accessible to both promoters and producers by building an extremely profiled database with crucial information to engage a future targeted and efficient marketing & sales action; on the other hand, it allows the wine lover to receive via email the technical files of all the wines they tasted, inclusive of detailed references of the exhibitors.

No information will ever be lost, and a better, more continuous relationship between producer and wine lover will be forged.

In short, MEMORvINO's strength is that it can finally structure a sort of continuity to the tasting, providing all the

<sup>4</sup> US Senate Joint Economic Committee Report from March 2018, Chapter 9: Building a secure future, one Blockchain at a time: «While smart contracts might sound new, the concept is rooted in basic contract law. Usually, the judicial system adjudicates contractual disputes and enforces terms, but it is also common to have another arbitration method, especially for international transactions. With smart contracts, a program enforces the contract built into the code.» (p. 210). [https://www.jec.senate.gov/public/\\_cache/files/aaac3a69-e9fb-45b6-be9f-b1fd96dd738b/chapter-9-building-a-secure-future-one-blockchain-at-a-time.pdf](https://www.jec.senate.gov/public/_cache/files/aaac3a69-e9fb-45b6-be9f-b1fd96dd738b/chapter-9-building-a-secure-future-one-blockchain-at-a-time.pdf).





Fig. 2. MEMORvINO's benefit overview (Source: Wenda internal files).

event's actors with useful information thanks to an overall involvement.

### 3. Discussion

With regards to the Food & Beverage sector, particularly if the wine industry is taken into account, many scholars pointed out the dynamism and complexity of global markets (Anderson and Nelgen, 2011; de Magistris et al., 2011; Lockshin and Corsi, 2012; Mariani et al., 2012). Globalisation has boosted competition in wine markets (Giuliani et al., 2011) and firms are engaged to face the effects of globalisation and opportunities in new markets such as Chile, South Africa, Australia and China, which had a wine market worth an estimated US\$ 38.3 billion in 2015, and is expected to increase 81%, reaching an anticipated US\$ 69.3 billion by 2019. Since 2010, the volume of wine sales in China has increased by 132%, reaching 2466 million litres in 2015. This amount is expected to grow another 75% by 2019, reaching 4320 million litres (Market Access Secretariat of the Canadian Agriculture and AgriFood Department, 2016).

According to Stasi et al. (2016), in this new competitive arena firms that invest in technologies for wine standardisation, processes optimisation and control, certifications and cost reduction usually increase their competitiveness. For instance, in the 80s, data-loggers started to be widely available, all providing travel data on papers or excel files. Then, a few years ago the same data-loggers turned smarter, thanks to various technological leaps which made real-time network connections broadly common. Even though data were delivered directly on the web, those were still unstructured data - and not actionable information on the basis of which managers

could take actions swiftly and in a standardised way. With these kinds of systems, data are nowadays available for anyone who has the device in their hands. This is just a small example of the way innovations might boost the ability of the entire production system to combine reliable technologies, product differentiation and tradition (Bernetti et al., 2006). Despite the difficulty to find the right balance among these aspects, firms are looking for a combination between company's traditional values and new innovative strategies that will allow them to achieve and maintain competitive advantages while preserving a strong brand identity, which has been built over the years (Vrontis et al., 2016).

The wine market is particularly attractive for developing innovative solutions that have the potential to improve process efficiency and the connection between businesses and customers. In this sector, ideas and solutions from a number of international and national startups can make a contribution, especially if we consider that 51% of companies employ digital technologies to enhance the product's origin, particularly when dealing with high added value goods such as wine. In this scenario, 46% of companies used digital solutions to improve Food Safety practices, while 25% of companies focused on production methods. Also, 12% of companies deployed technology to improve the quality of their services, adopting innovative solutions to communicate product and process information to consumers (origin, traceability data, environmental impact) (Smart AgriFood, 2018).

According to the Boston Consulting Group (StartupBusiness, 2017), "wine is a potential market worth billions in Italy and worldwide, a very large market where scalability of a startup has a way of expressing and determining its success. It is difficult to predict how startups will

develop within the next 5 or 10 years. 26,792 startups are relying on IoT as one of their main technologies to launch new products and services and support platform-based business models. By 2020, 50% of IoT spending will be driven by discrete manufacturing, transportation and logistics, and utilities.”

A recent survey carried out by McKinsey & Company shows that “some companies, for instance, have placed sensors in food packaging that track a product's location throughout the distribution supply chain. Simple tracking and alert functions are relatively easy to deploy because they do not require advanced analytics, complex algorithms, or data-science capabilities, allowing them to generate value quickly.” (Patel et al., 2017).

In the following, some conclusions and some future perspectives will be outlined.

#### 4. Conclusion

It has been shown what is the potential of new technologies such as IoT, Big Data Analytics and Blockchain and how it is possible to use them to both drive wine supply chains and provide a smart environment for wine exhibitions. In addition to the importance of new technologies applied to processes, it is crucial to highlight the startup approach towards innovation-enabling and how Wenda fully fits this particular mindset: it has identified market problems and it has designed effective solutions to address them by working with researchers, industry experts and acceleration programs to overcome technological hurdles, correct mistakes in its development trajectory and constantly improve the whole business environment, from producers to consumers. Like any startup, in its early stages, Wenda has faced a lack of information, high uncertainty, pressure from competitors, the need to make decisions quickly. But thanks to both its resilience and the mentoring it received from important players, first in the wine market and later in the Food & Beverage industry, Wenda is now evolving at a fast pace, creating new value for the wine supply chain and the Food & Beverage industry at large. Through a strong and constant belief in the power of innovative technologies, in their ability to deliver quality services and solutions, in their potential for boosting transparency, efficiency, reliability, consumer protection and satisfaction, Wenda managed to shape its working processes in the spirit of continual improvement. In this way, it will continuously offer ever better performances and produce a never-ending change focused on increasing both effectiveness and the scope of its activities, to position itself at the forefront in the global AgriFood logistics industry, delivering the only cross supply chain and cross-device platform that can turn supply chain control from a cost to a competitive advantage.

#### Conflict of interest

There is no conflict of interest.

#### References

- Anderson, K., Nelgen, S., 2011. Wine's Globalization: New Opportunities. New Challenges. Wine Economics Research Centre of the University of Adelaide. Working Paper 0111.
- Bernetti, I., Casini, L., Marinelli, N., 2006. Wine and globalisation: changes in the international market structure and the position of Italy. *Br. Food J.* 108, 306–315. <https://doi.org/10.1108/00070700610657146>.
- Czibulya, Z., Kollár, L., Pour Nikfardjam, M., Kunsági-Máté, S., 2012. The effect of temperature on the color of red wines. *J. Food Sci.* 77 (8), C880–C885. <https://doi.org/10.1111/j.1750-3841.2012.02826.x>.
- Davenport, T.H., Harris, J.G., 2007. *Competing on Analytics: the New Science of Winning*. Harvard Business School Publishing, Boston, MA.
- de Magistris, T., Groot, E., Azucena, G., Albusu, L.M., 2011. Consumers preferences for wine in Spain: best-worst scaling methodology. In: *Paper Prepared for Presentation at the EAAE 2011 Congress Change and Uncertainty Challenges for Agriculture, Food and Natural Resources*.
- De Mauro, A., Greco, M., Grimaldi, M., 2016. A formal definition of Big Data based on its essential features. *Libr. Rev.* 65 (3), 122–135. <https://doi.org/10.1108/LR-06-2015-0061>.
- Giuliani, E., Morrison, A., Rabellotti, R., 2011. *Innovation and technological catch-up: The changing geography of wine production*. Edward Elgar Publishing, p. 232.
- Grappi, G., 2016. *Logistica*. Ediesse, Roma.
- Lockshin, L., Corsi, A.M., 2012. Consumer behaviour for wine 2.0: a review since 2003 and future directions. *Wine Econ. Pol.* vol. 1 (Issue 1), 2–23. <https://doi.org/10.1016/j.wep.2012.11.003>.
- Mariani, A., Pomarici, E., Boatto, V., 2012. The international wine trade: recent trends and critical issues. *Wine Econ. Pol.* 1, 24–40. <https://doi.org/10.1016/j.wep.2012.10.001>.
- Market Access Secretariat of the Canadian Agriculture and AgriFood Department, 2016. *Global analysis report sector trend analysis: the wine market in China*. <https://www.agr.gc.ca/resources/prod/Internet-Internet/MISB-DGSIM/ATS-SEA/PDF/6799-eng.pdf>.
- Menghini, S., Fabbri, B., 2013. *Qualità e tracciabilità della filiera dei vini a denominazione: per la tutela del consumatore e la competitività delle imprese*. FrancoAngeli, Milano.
- Najafabadi, M.M., Villanustre, F., Khoshgoftaar, T.M., Seliya, N., Wald, R., Muharemagic, E., 2015. Deep learning applications and challenges in big data analytics. *Journal of Big Data* 2 (1), 1–21. <https://doi.org/10.1186/s40537-014-0007-7>.
- Patel, M., Shangkuan, J., Thomas, J., 2017. *What's New with the Internet of Things?* McKinsey & Company. <https://www.mckinsey.com/industries/semiconductors/our-insights/whats-new-with-the-internet-of-things>.
- Sanders, N.R., 2016. How to use Big Data Analytics to drive your supply chain. *Calif. Manag. Rev.* 58 (3), 26–48. <https://doi.org/10.1525/cmr.2016.58.3.26>.
- Osservatorio Smart AgriFood, 2018. *Coltiva dati. Raccogli valore*. In: *La trasformazione digitale dell'agroalimentare*, Symposium, Milan, 23rd January 2018. [https://www.osservatori.net/it\\_it/osservatori/comunicati-stampa/coltiva-dati-raccogli-valore-la-trasformazione-digitale-della-agroalimentare](https://www.osservatori.net/it_it/osservatori/comunicati-stampa/coltiva-dati-raccogli-valore-la-trasformazione-digitale-della-agroalimentare).
- StartupBusiness, 2017. *The Italian startups making wine economy greater than ever*. <https://www.startupbusiness.it/italian-wine-economy-startups/92695/>.
- Stasi, A., Muscio, A., Nardone, G., Seccia, A., 2016. New technologies and sustainability in the Italian wine industry. *Agriculture and Agricultural Science Procedia* vol. 8, 290–297. <https://doi.org/10.1016/j.aaspro.2016.02.023>.
- Vrontis, D., Bresciani, S., Giacosa, E., 2016. Tradition and innovation in Italian wine family businesses. *Br. Food J.* 118 (8), 1883–1897. <https://doi.org/10.1108/BFJ-05-2016-0192>.