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Digital technologies to remove the information asymmetry in the food market

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ABSTRACT

In today's economic system, the quality of food production and the economic efficiency of the markets are closely connected and linked to the growing role of information. We must highlight that in the food market, the safeguarding of safety and the correct transmission of information very often does not go towards protecting consumers. From the point of view of the economic efficiency of the product markets, these elements contribute to creating a sort of functional distortions capable of preventing their correct functioning from the point of view of economic theory and of fueling misunderstandings and information asymmetries. These specific conditions seem to be able to produce disadvantages at the same time for producers (agricultural enterprises and food enterprises) and for consumers in terms of the natural contest of relationships between supply and demand both in markets oriented towards short-term and long-term equilibrium. The research highlights how the modern analysis of the role of information, through digital technology, and the evaluation of the qualitative value of agri-food production can contribute to the improvement of the functional efficiency of agri-food production markets and also reduce the information asymmetries on the question. The results of the study highlight that the Yuka app 'offers a very efficient service that analyzes, by simply scanning the barcode of a food product, the composition of a wide range of foods, drawing on an extremely comprehensive and constantly updated database. This seems particularly important for the positive effects it can have on the food market as it would ensure greater transparency in transactions making the food market more efficient.

1. Introduction

In developed economies, the quality and safety of agri-food products are receiving increasing attention from consumers. This situation stems from higher per capita income, as the primary need to feed oneself is met, consumers seek quality attributes to go with food. The structural evolution of food demand is also affected by the growing international competition from multinational food distribution companies that guide consumers in their choice of food. In this highly competitive environment, knowledge and interpretation of when and how consumers inform themselves, research, obtain, perceive, and evaluate quality understood as added value, and an increase in their willingness to pay becomes increasingly important. Moreover, while it is possible to establish a variable scale of values based on sensory perception of a food's quality in terms of taste ranging from very good to very bad, without judging its potential edibility, this is not possible to define the healthiness and hygiene safety of products available in consumer markets. The consumer in front of a food product that is made available for purchase cannot a priori say whether it is good or bad or even whether it is a quality or non-quality food product since he or she has to trust the distribution company and also the food company that produced it (if it is food industry products) or the agricultural company (if it is fresh fruit and vegetables). In developed economies, consumers have long shown increased attention to investigating the characteristics that define the quality of food products, due to greater availability in the marketplace and an environment that is more sensitive to these issues. Quality is a multidimensional and dynamic concept. "Quality is, in fact, a complex value whose definition includes competing objective and subjective components. That is why quality is not an immediately descriptive or identifiable characteristic but is, above all, an idea that each of us has about what satisfies a specific need. The more the characteristics of a product correspond to the set of expectations we have about it, the more we are convinced to consider it of quality" [1]. Quality in some ways could also be a subjective value. Therefore, the quality of a food product depends on the tastes of the consumer and the territorial context where he or she lives in that what each consumer considers for him or to be "good" is the result of the food habits of the area, the climate, the availability of food and the professionalism it performs. At this point it becomes important

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to deepen the analysis of the perception of quality aspects, together with quality indicators, in the objective, technical sense, as well as measures and models of interpretation of customer satisfaction in the theoretical context of 'information economics. The introduction of certified quality products into the market reflects an increase in their production costs, and as a result, the entrepreneur expects the market to express higher prices, leading to the need to estimate the economic value attributed to their quality (premium price assessment) by the end buyers of such products about the increased willingness to pay. The assessment of the role of information as an element interacting with the functional mechanisms of markets requires to be treated from a dual perspective: on the one hand, the "control" and "management" of the information asymmetry between supply and demand through policies of branding, certification, and labeling of agri-food products; on the other hand, the bodies and institutions - public and private, national and international - that govern the voluntary regulation and implementation of rules and procedures as tools for controlling the costs of market transactions (corporate brands, collective brands, agreements on specific quality indicators, value indicators, and with a communicative function that helps to strengthen the operating conditions necessary for the realization of economic exchanges, helping to reduce the information asymmetry characteristic of imperfect markets) [2]. The deterritorialization of food production, the decomposability of complex production processes that used to be done in one place and now follow the economic logic of lowering production costs due to product and process innovation, determines the knowledge of a flow of information to make the food market efficient. In addition, at present, the quality of agrifood production and the economic efficiency of markets are closely connected and related to the growing role of information that correlates with the increasing spread of the web. It is possible to say that this kind of situation does not always safeguard the safety and correctness of information and at the same time the ability of consumers to make informed and complete choices. From the point of view of the economic efficiency of production markets, these elements contribute to a kind of functional distortions that can prevent them from functioning properly from the standpoint of economic theory and fuel misunderstandings and information asymmetries that cause the market to fail. These specific conditions seem to be able to produce disadvantages simultaneously to producers and consumers in terms of the natural contention of supply and demand relationships in both short- and long-term equilibrium-oriented markets. For all these reasons, the paper aims to highlight how modern analysis of the role of information and assessment of the quality value of agrifood production can contribute to improving the functional efficiency of agrifood production markets and can also reduce information asymmetries on the demand side. Digital technologies improve business competitiveness [3], enable greater information exchange by reducing uncertainty in choices [4] improve food quality and safety [5] finally improve business productivity, and facilitate international transactions [6]. In this study, we asked how modern technologies allow for breaking down the information asymmetry present in food markets and make food transactions transparent. To achieve this goal, we analyzed the Yuka Application. In the present study, after analyzing the problem of information asymmetry and thus distortion of food markets, through methodology we next examined how the Yuka Application would enable a more efficient market.

2. Materials and methods

In the post-modern economy, information theory has encompassed markets for goods and services, expectations, supply contracts, the new economy, and other important issues in the field of economics. The absence of information and/or the presence of asymmetry in the information sets of economic agents has a significant impact on the functioning of economic systems. Consumers when buying a good are in a condition of contractual inferiority to the seller who knows how that particular good was made. Thus, in this transaction, there is a contractual inferiority of the buyer to the producer that results in a distortion of the efficient equilibrium of the food market. Abandoning the assumption of perfect and symmetric information in the market for economic agents at first might mean adding further, to the cost of the production process, the cost of information to determine the apparatus of general economic equilibrium [7]. So in the context of farms, if an entrepreneur produces leafy vegetables, wine, or oil and at first trusts the market because he thinks that particular market is efficient in that there is perfect information; on the cost of producing leafy vegetables, wine or oil one must add cost that of information. Research by economists such as Akerlof, Stiglitz, and Spence showed that the abandonment of this assumption had very important consequences for the functioning of markets, starting with the idea that the fundamental theorems of welfare economics were no longer valid [8]. In the context of the problems of the market for goods and services, information economics can better understand the behavior of agents operating in agri-food markets and, in particular, the problem that characterizes these markets in terms of the perception and evaluation of the quality of products subject to economic transactions between producer and industry, between industry and distributor, and between distributor and consumer. First, it is indisputable that, following Stiglitz [9], in many cases, a higher price is a potential indicator of quality.

If Ca is the cost to produce a unit of high-quality good, p is the price and r is the interest rate, the discounted flow of profits for the firm producing high quality is:

$$p - Ca/r \tag{1}$$

While if Cb is the cost of producing one unit of the low-quality good, the profit for the firm producing the low-quality good, selling it at the price of the high-quality good, is:

$$p - Cb/1 + r \tag{2}$$

It will therefore be profitable to produce the high-quality good when

$$p - Ca/r > p - Cb/1 + r \tag{3}$$

That is, if

$$p > Ca + r\,(Ca - Cb) \tag{4}$$

The price of the good must therefore be above a certain level p* below which it is unprofitable for firms to produce high quality. Below the price p*, the supply of high-quality products disappears from the market. The result is that they would be willing to pay less for what they would have agreed to pay more for (an unquestionably high-quality product) and to pay more for what they would have paid less for (a low-quality product)" [10]. As Calabrò and Vieri note, "this confirms that, in a situation of uncertainty, consumers reduce their willingness to spend more on goods they would prefer instead, as they are unable to recognize them skillfully. For the same reason, he pays more for goods as they are of less value" [11].

3. Results and discussions

According to the methodology, information asymmetry results in market failure. To eliminate this problem, digital technologies provide apps that can bring the market back to efficient levels. In particular, the Yuka 'app offers a very efficient service that analyzes, by simply scanning the barcode of a food product, the composition of a wide range of food products, drawing on an extremely comprehensive database that is constantly updated. The evaluation method is based on three objective criteria: The main one refers to the Nutri-Score parameters, which consist of a food labeling system developed in France to simplify the identification of relevant nutritional values. In addition, the presence of additives and their respective health risk factors are checked, which are based on independent studies carried out by authoritative scientific food research organizations such as EFSA, ANSES, and IARC. Finally, the

presence of an organic label is also considered. The operation of Yuka is very simple and intuitive: the main screen of the basic version, which is shown to you as soon as you register, provides a button, located in the lower right corner, that starts the camera to allow you to scan the barcode of a product. As shown in other studies, the use of digital technologies increases business competitiveness [12,13] and improves transactions [14]. Markets and trade in agri-food products are characterized by an ever-changing competitive environment of the regulatory framework and the redefinition of international trade agreements. It, therefore, becomes essential for companies and individual producers to turn to the strategic goal of quality, namely: quality of production systems, quality of products and services offered, quality of supply chains, quality of the environment, and territorial specificities. Indeed, there is also an ever-increasing demand for safe and quality food products from consumers in developed economies. This is evident with particular reference to short supply chains, where the end consumer is increasingly aware of the specificities of food producers [15,16]. This means that consumers pay attention not only to "what it says," but also to "who writes" product information. The need for enterprises to showcase the characteristics of their production facilities and make them immediately visible and assessable inevitably confronts them with regulatory constraints as well as the many promotion opportunities offered by quality certification. In addition, the structural and entrepreneurial characteristics of supply chain operators affect their ability to adapt and improve agrifood production. However, this strategy is necessary because, in the globalized market, there is a shift of production from countries where production costs are lower to localized markets where production costs are higher [17]. In the context of internationalized markets and quality-oriented innovations in processes and products, food safety, along with accurate information, is becoming a way to ensure corporate competitive advantage [18,19]. An image of quality achieved by complying with production specifications and sanitation controls and by using labeling and mechanisms of designation of origin is emerging; at the same time, the individual idea of quality, the expectations, and demands expressed by modern, global, informed consumers, who are therefore demanding and careful about their purchasing choices and decisions, is strengthening. Consequently, in terms of quality, it is clear that its formal recognition must in any case take into account the measurement of its intrinsic characteristics and the subsequent substantiation of these characteristics to what can be expected, meaning a system of rules (of production, control, certification, etc.). It follows that, for the formal recognition of quality, nothing is worth more than certification and marks issued, and thus guaranteed, by the Public Authority. But the discipline of quality alone, however important, may be insufficient to represent and safeguard the set of values that are expressed in a reality such as the Italian one, largely characterized by the variety of products and the link of products with the territory" [20]. This situation is evident in livestock production, which, although characterized in many cases by designation of origin schemes, may have some uncertainty about the origin and quality of some inputs, such as animal feed. Feed safety is important for animal health, the environment, and the safety of food products of animal origin. There is, in fact, a link between feed safety and the food that reaches our tables. In this context, European animal nutrition legislation provides a framework to ensure that animal feed poses no threat to human or animal health or the environment. It is commonly believed that the perception of the quality of food products of animal origin, which are strongly characterized by a close link to the place of origin and the raw materials used, cannot gain much trust from end consumers; it is enough for the concept, or rather, the idea of quality throughout the supply y chain of these products to be associated with the possible use of raw materials containing genetically modified organisms. But that is another issue. At the same time, it is also possible to argue that the regulatory framework of controls and certifications of origin of agri-food products can contribute to the reduction, albeit partial, of cases of underestimation, errors in the attribution of high and low quality to products, misunderstandings, incompleteness and/or asymmetries in the information disseminated in the markets, both on the demand and supply side, bringing the terms of the discourse back to the well-known case analyzed by Akerlof (1970) and discussed above.

4. Conclusions

Increasing international competition, the prevailing logic of big business, and the need for quality food products dictate the redefinition of enterprises' operational strategies. These strategies are to protect them in the logic of acquiring and maintaining a durable competitive advantage. In fact, at present, the agribusiness market faces, on both the demand and supply side, a complex global system of dissemination, circulation, and retrieval of a heterogeneous flow of information about products and services, which comes from a wide range of sources. The imperfect and asymmetric information available to consumers results in divergences between expected and actual quality. The utility consumers receive from a given food product depends largely on its inherent quality characteristics, about which consumers are not adequately informed; in fact, they do not have sufficient information on which to rely to make consistent and comprehensive choices [19]. For this reason, the success factors of competitive market competition call for a comprehensive and integrated approach to the concept of total quality [20], aimed at adequately enhancing the value of food products of certified quality and, at the same time, decisively counteracting the rampant phenomenon of the entry and promotion in national and international markets of products of poor quality and dubious origin, which are certainly competitive in terms of price to the public. Agribusiness producers need to develop effective and transparent communication, promotion, and product image renewal strategies, with a focus on factors such as quality, consumer safety, controls, and traceability along production and trade chains, as well as the intention to comply with social and environmental sustainability standards. These are, in our view, the strengths that entrepreneurs can and should strengthen to offset the competitive disadvantages of higher production costs associated with the production of quality goods and the high prevalence of food counterfeiting and adulteration. The application proposed in this paper goes in this direction, that is, in making transactions in the food market transparent. The issues discussed here find adequate interpretation from the economic models of information theory, as confirmed by some empirical evidence from agri-food markets, where information asymmetries are frequent, which can be remedied through voluntary and binding regulatory instruments created to defend and improve quality. Brand policy at the production and/or commercial level, by contributing to the "construction" by consumers of the perceived value of the product and/or service in terms of attributes of trust, experience, and research, becomes a vehicle for enhancing product quality since it significantly reduces information asymmetries, where present, as well as the prevalence of the trust component, in favor of the attributes of research and experience that are verifiable and consistent with the modern food safety objectives required by the market itself. It is clear that quality certification in the agri-food production sector if properly conveyed through a secure, widespread, accessible, transparent, and shared communication profile, can significantly contribute to the reshaping of the conditions of information asymmetry in the markets and, at the same time, increase the ability of consumers to perceive this information as a real added value, in terms of "greater value" attributed to the product or service of interest. To this can be added the opportunities for the enhancement of quality systems offered by the activation of microbranches at the local level to ensure, promptly, the quality of products and services in an integral manner and facilitate, at the same time, the consolidation of local and diffuse rural development models. In this sense, it is believed that, in the face of the challenges posed by globalization, there are only two ways to say: either you can be competitive on a global scale, concerning production costs, or you are oriented toward products and goods that the market recognizes for their high quality and, in some cases, uniqueness

and, therefore, escape the constraint of competitiveness based on production costs. Finally, the importance of the binding role of the specific and defined system of rules (for production, control, certification, labeling, etc.) in the EU platform and markets for agri-food products, in terms of the competitiveness of agri-food markets and trade, cannot be discounted. It follows that, for the formal recognition of quality, nothing is worth more than certification and marks issued, and thus guaranteed, by the Public Authority, which is increasingly demanded by contemporary consumers. The objective of the present study was to analyze how information asymmetry leads to food market failure and to investigate what tools of modern information technology can help solve this situation. As demonstrated in this study, the use of the Yuka app allows for more transparent transactions and therefore more efficient market. However, one wonders whether all consumers are able to use the Yuka app using the app always requires a minimum of computer knowledge and therefore would cut off all those consumers who are averse to digital technologies. This should be investigated in order to make digital technologies easier.

Declaration of Competing Interest

We declare not to be in a conflict of interest Smart Agricultural Technology.

Data availability

Data will be made available on request.

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