

The 4.0 pasta factory

Abstract

Not only big companies, but also small and medium enterprises are affected by the new industrial revolution. We can notice an evidence of that in “La fabbrica della pasta di Gragnano”. The Moccia family, owner of this pasta factory, managed to implement modern technologies in a typically handmade production process. New technologies can be implemented in traditional activities too, and are not adequate only for modern scenarios.



Introduction

Gragnano is a small Italian town of 28 857 inhabitants in the metropolitan city of Naples in Campania. It is well known at European level as the city of pasta. In fact, it's the city that produces and exports the largest quantity of pasta in Italy. Pasta production dates back to the end of the 16th century when the first family-run pasta factories appeared. Until the seventeenth century it was an uncommon food but, following the famine that hit the Kingdom of Naples, it became a fundamental food thanks to its nutritional qualities and the invention that allowed the production of pasta at low cost by pressing the dough through the dies. The ideal soils to allow the production were Gragnano and Naples, thanks to their strategical geographical position and their favorable climate made up of wind, sun and the right humidity, which contributed to the development of the dry pasta production sector. The inhabitants of the Kingdom of Naples were the first to give important turning points to the production of pasta, and soon Gragnano became the largest pasta producer in the world, particularly in the sale of macaroni, thanks to the numerous family-run pasta factories that, in 1800, transformed the city into a real pasta industrial district, so important to even affect the urban plan of the city. Today some producers have managed to patent some types or variations of pasta. The fame grew slowly, until the coveted IGP mark that the European Union finally conceded in 2010, recognizing Gragnano's pasta as a product worthy of protection from abuse and counterfeiting, witnessing the existence of an ancient tradition that had lasted for over 500 years and consecrating Gragnano as the "city of pasta". The European trademark guarantees the origin and quality of the product and becomes a shield against counterfeiting and abuse. In order to be able to bear the "Pasta di Gragnano" mark, the producers must follow a strict set of rules.

Gragnano pasta must be produced exclusively with durum wheat semolina and water from the local aquifer. Production must take place within the Municipality of Gragnano. The production process involves, after mixing and kneading, extrusion through bronze dies. The next production phase is that of drying, which varies according to the formats and in any case takes place at a temperature between 40 and 80 ° C, for a period of between 6 and 60 hours, in static drying cells or in tunnels where hot air circulates. Once dried, the pasta is left to cool and within 24 hours it must be packaged, without being transported, to allow perfect preservation of the product. The Gragnano pasta must finally be packaged in cardboard boxes or transparent bags

or in packaging made with material of vegetal origin or other recyclable material permitted by EU regulations. Today, Gragnano produces approximately 300 thousand tons of pasta which get exported to 42 countries all over the world, recording a turnover of over 370 million euros. The first pasta factory to obtain the IGP mark was “La Fabbrica della Pasta di Gragnano” in 2010.

The company was founded in 1976 by Mario Moccia, the father of the current owners. Despite being an important and historic cheese maturer, he was unable to resist the call of being from Gragnano and purchased a famous pasta factory - but in deep crisis - dedicating, with not a few difficulties, in an unhappy moment for the pasta market, his whole life to the total restoration of the building in the historic center, to the construction of the new factory, as well as to the relaunch of pasta and to the birth of the first pasta factory consortium di Gragnano, the COPAG. He contributed actively and importantly to the affirmation and requalification of Gragnano pasta on markets all over the world. In 1994, after long battles, Mario Moccia sold the company which was, however, bought back in 2007 by his sons, Ciro, Antonino, Marianna and Susanna. They say they couldn't resist to the magic of the exalting flavors and aromas of Gragnano: “Being born and living in Gragnano means being pervaded, intoxicated by the exalting flavors and aromas of durum wheat semolina, from the pasta that derives from it, and ... as if by magic ... you can no longer live without it!” The goal of the new ownership is to weave tradition and innovation to obtain a high quality product which can be exported all over the world. Ciro Moccia, one of the young producers, states in an interview released to the newspaper “Il sole 24 ore”: “We don't just sell pasta, we tell it. We have recovered the art of making old-fashioned pasta for passion: we use high-quality low-ash and high-protein durum wheat. The present is called tradition, the future export”.



The goal of “La fabbrica della pasta” is to combine modern technologies and ancient traditions, so production goes at the same pace with research and technological development.

The company's policy can be well understood from this statement; innovation is seen as a tool to support and share a great tradition. Today, the company employs 70 employees and produces sixty quintals of pasta daily (90% more than in 2006) which it mostly (70%) exports all over the world; Europe, China, Brazil, Canada, Dubai and Hong Kong are some examples of countries where it is possible to find this "Made in Italy" product. This study case witnesses that innovation is not to be thought only in regard to the new technological activities, but it has to penetrate in the traditional activities to give them a boost.



Pasta packs produced by “La fabbrica della pasta di Gragnano”

Challenges

Following the obtaining of the PGI certification, the Gragnano Pasta manufacturing process must comply with strict rules which, inter alia, impose documented traceability of each phase of the production process. Digitalization is a serious challenge that allows to have in every moment all the production phases at hand, thus reducing waste and working times, as well as having a very efficient traceability. To meet these needs “La fabbrica della pasta di Gragnano” introduced highly innovative solutions, studied specifically by Zucchetti, which automatized the production process, transformed the company into a real 4.0 pasta factory and earned the Moccia family several awards, including the SMAU prize in 2017. The work was complex because there was the need to modulate the production according to the different formats, but above all to monitor through sensors the context conditions, such as temperature and humidity, the quality of the ingredients, from flour to water, the conditions of the dough and its reactions to the alterations minute by minute. Other challenges are the search of equilibrium between innovation and tradition in a low-tech sector, the search of high-quality raw materials, the integration between producer and farmer to ensure a flow of local wheat within the required times and the creation of a network that connect local businesses. The goal of “La fabbrica della pasta” is to combine modern technologies and ancient traditions, so production goes at the same pace with research and technological development. The company invests, for this reason, 7% of its turnover in marketing and 5% in technological innovation every year.

Solution

Being the first pasta factory in the world with a IGP certificate, “La fabbrica della pasta” is subject to strict regulations in terms of work organization. Through a software which, monitors the entire production process, from the supply of raw materials, through the various stages of production, up to the storage of the single pack and the delivery of the finished product which gets placed on the shelf. This technology, other than controlling and modulating production, allows to gather information about the temperature, the humidity, the quality of the

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ingredients, the conditions of the dough and its reactions to the change in the surrounding environment by means of a network of sensors. These data are very valuable since they allow to notice, in a small period of time and with low error risk, if a product respects the expected quality standards. Based on these acquired data, it is then possible to regulate the processing phase if the quality of the product does not comply with the one that is requested. At the same time, it is also possible to notice if the quality of raw materials is below standards and consequently take new supply decisions. The entire data acquisition process takes place in real time and in a completely automatic way, through the use of readers, portable devices and sensors installed throughout the factory. Such well-integrated management system has the effects of reducing processing times and waste as well as complying to the needed requirements for the IGP certification. Furthermore, the packaging department has been automated through the insertion of an anthropomorphic arm that facilitated the operators' work by collaborating side by side with the packaging staff. This new type of robot, called "cobot" (collaborative-robot), consists of a single mechanical arm, is able to learn the tasks on the field and can replicate human movements. This is possible thanks to an artificial neural network which allows to gather information, process them and produce an action as an output. Such learning method is called "reinforcement learning". The machine observes the outdoor environment through optical viewers, studies the movements of the human collaborator at his side and understands what it needs to do and what it should not replicate. It differs from the traditional robots because the latter are very bulky, have very high costs and can only perform repetitive operations which have been previously programmed. Using Zucchetti IT solutions and integrating them with the experience and the work of the family, the Moccia brothers managed to innovate the packaging sector by introducing anthropomorphic robotic technologies, while



maintaining the workforce that now controls all the steps moment by moment. The results obtained, such as the reduction of processing times, saving of electricity, reduction of production waste and easier work for the operator, make up for the huge initial investments and will most likely allow a return on investment in about 4-5 years. To achieve these results, the company has also worked on skills, accompanying workers in this digitalization process which requires adequate training and continuous updating. At the end it's possible to say that the Moccia family managed to transform an artisan pasta factory into a 4.0 workshop.

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