

9.1 The slow factory: a new paradigm for manufacturing

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Abstract

The current industrial system is generally based on highly automated manufacturing plants, which allow fast production and serial manufacturing. However, some Italian entrepreneurs, using their expertise and know-how, have decided to recover the value of tradition and craftwork and are finding that slow working processes can produce positive results and add distinctive value to a product. Similar cases are recognizable all around the world and in different industrial fields; in particular slowness in the food industry is of great significance.

Slow Manufacturing can increase the quality of the product, giving the uniqueness and excellence that attracts the most demanding of customers. Traditional machines can be fitted in order to assist modern automatic equipment and skilled workers can thus perform semi-automatic processes in order to obtain appealing high-caliber goods. Technology returns to being predominantly mechanical. The reduction of electronics and computerization, the elements largely responsible for standardization, allows the skills of the craftsman to once again become relevant.

Keywords:

Craftsmanship, Made in Italy, Manufacturing, Slowness, Sustainability

1 INTRODUCTION

Manufacturing is the driving force of the European community, providing more than 30 million jobs and contributing over 6,500 billion Euros in gross domestic product (European Commission 2013). Consequently, industrial leadership is one of the main targets of current European framework programs and the support of industrial innovation and development is always one of the main concerns of national and regional governments across Europe.

Italy has shown significant economical growth since the Second World War predominantly based on manufacturing activities, specializing in traditional sectors and obtaining a good ranking in the international market for products such as garments and furniture. The term "Made in Italy" indicates the artisanal and industrial products generally related to four sectors: Fashion/Textiles; Furniture/Interior Design; Food/Beverage; Automation/Mechanics. The first three refer to traditional productions, while the fourth involves advanced technology and derives from the need of equipment to manufacture the traditional products. Made in Italy production corresponds to over 65% of Italian manufacturing activity. Many factories are located in industrial clusters: territorial concentrations of interconnected medium-sized enterprises - a chain of production - involved in similar activities. At present, 223 clusters are recognized in Italy, for historical and geographical reasons each one originated from a specific vocation of the territory towards a particular production. This industrial system has for years maintained a high ranking within the most industrialized eight countries and made Italian products internationally esteemed. Made in Italy is a sign of quality and prestige, evoking the idea of good taste together with careful attention to every detail of the product.

Recently, the internationalisation of production has led to the possibility to manufacture products in developing countries where the cost of labour is lower than in Italy. As a result,

many European industries have established production plants in low-cost workforce countries, assembling parts and components from all over the world in order to achieve the optimum balance between quality and cost. The development of emerging countries such as Brazil, Russia, India, China and South Africa - the so called BRICS - has determined an increase in worldwide competition in the field of manufacturing by threatening the economic leadership of many industrialized countries, forcing them to find new paradigms of production in order to maintain their standing. It is not possible for traditional Italian medium-sized enterprises to compete with emerging countries in terms of production costs, but maintaining production inside the clusters assures the high manufacturing competencies that characterise Made in Italy. At the same time, goods manufactured in many developing countries are also increasing their quality despite offering low prices, leading industrial entrepreneurs to develop new paradigms of manufacture so producing items with added value; attracting customers by offering uniqueness. The concept of the "slow factory" is one of these new manufacturing approaches.

2 THE VALUE OF CRAFTSMANSHIP IN MANUFACTURING

2.1 Tradition and craftsmanship

Italian industrialization started in the postwar period thanks to small regional craft enterprises that based their production on local tradition and culture. Automation and mechanics industries have flourished in the Bologna area where silk mills have operated since the Middle Ages, the mechanical skills involved being transferred down through the generations. Glass manufacturing developed in Venice with the presence of craftsmen who produced objects for the courts of the richest and most powerful kings in XVI and XVII centuries and created a "glass culture" in this area. Tuscany leather garments and accessories are well known and in high

demand, with the territory holding a long tradition in this field thanks to the availability of raw materials and local skills. These are three examples of Italian clusters and many others could be mentioned. One of the points of strength of cluster enterprises is the capability of maintaining tradition and craftsmanship in production, creating a product that, despite being industrial, is still in some way unique.

Product value is mainly in intangibles like brand, style, and design and can reflect the culture of the area where the manufacture takes place. This issue is universal and can be applied to different regions of the world, not only in Italy, though perhaps it is in the Italian territory where the most significant application is found.

The industrial revolution enabled the production of high numbers of items by the use of machines. Mass production was achieved, allowing greater availability of goods for a larger number of customers. The diffusion and application of the Taylor theory to increase labour productivity contributed to the passage from craft to mass production, applying the principles of best practices, aiming to achieve maximum fragmentation to minimize skills requirement and job learning time. The manufacture of standardized products in huge volumes by unskilled workers using special purpose machines is the main issue of Fordism, a production principle born in the U.S.A. at the beginning of the XX century. It has been particularly popular in the automotive sector, though it is applicable in every kind of manufacturing process. Both Taylorism and Fordism present the idea of employing a work force that uses machines to do the job; workers who don't need to actively participate in the manufacturing of the product, their actions being limited to the handling of machinery. Critics believe that this approach means operators are passive and not creative and this in turn causes a low quality of working life.

The Japanese answer to Fordism and Taylorism is Toyotism, a production management philosophy developed after the Second World War at Toyota by Taichi Ohno [1], a mechanical engineer who spent all his professional life at this enterprise. The Toyota Production System (TPS) was focused on reduction of the Toyota seven wastes "Muda" (Transportation; Inventory; Motion; Waiting; Over-processing; Over-production; Defects) through different tools and methodologies, such as "Just in Time" and "Kanban", whose aims are the optimization of the production and the creation of product added value. The currently popular "Lean Manufacturing" approach can be considered an extension of Toyotism, where the capacity of the factory to quickly adapt to the market changes and customers needs has been enhanced. Lean manufacturing is primarily focused on designing a robust production operation that is responsive, flexible, predictable and consistent. This creates a manufacturing operation that is focused on continuous improvement through a self-directed work force and driven by output-based measures aligned with customer performance criteria. It develops a workforce with the capability to utilize the lean tools and techniques necessary to satisfy world-class expectations now and into the future [2]. The organizational aspect is therefore an important component of the lean factory, focusing on identification of people's roles/functions, training in new ways of working, and communication. Workers are requested to be able to use the lean machinery and equipment, which largely involve electronics, therefore needing specialist skills, and to participate in the whole lean

factory approach in terms of personal initiative and flexibility. Their role within the enterprise is more active than in a factory based on the Taylor or Ford approach, but still craft skills are not primary.

The idea of a revaluation of craftwork is not only Italian: some authors in recent years have enhanced this approach as a possible solution to the present economical crisis. Thomas L. Friedman [3] affirms "all that is standard is surpassed and American workers consider themselves as artisans in order to overcome the mass production paradigm and to make enterprises successful". Some "Makers" movements have recently come to life in the USA, with the underlying principle that people have an interest in making and repairing things. Richard Sennett [4] also believes that "our society needs to rediscover craft workers virtues, not with nostalgia for the ancient time but exalting the profile and characteristics of artisans (higher autonomy, dialogue with the client, social aspects of the job) in order to re-launch manufacture and create higher quality products". Chris Anderson [5], director of the magazine "Wired" maintains that "the next Industrial revolution will be led by a new generation of enterprises between high technology and craftwork, able to supply innovative products, highly personalized, on a small scale". In Italy a recent best-selling book by Stefano Micelli [6] discusses craftsmanship as the key word for a brilliant future for Made in Italy, describing how the history and tradition of handwork can still be the element to increase the competitiveness of Italian enterprises. Craftsmanship is described by Micelli as an "intimate familiarity and manual work on material and on shapes that it can assume", something that the use of CAD doesn't allow, where real images are created but devoid of concreteness. Francesco Morace and Giovanni Lanzone [7] talk about a "third Italian Renaissance": after the first in XV century with figures such as Leonardo da Vinci and Michelangelo, the second in the 1950s with Italian design from the likes of Giò Ponti and Adriano Olivetti. This third Renaissance corresponds to a re-launch of Italian manufacturing, based on small and medium-sized enterprises, enhanced craftsmanship and strongly connected to the territory, local tradition and culture.

2.2 Sustainability and crafts-industrial production

The meaning of craftsmanship in manufacturing doesn't refer only to the added value of the product in terms of quality and uniqueness but also to the sustainability of the manufacturing approach. Sustainable manufacturing implies methods and techniques of production that allow workers to express their skills and creativity, contributing to the improvement of the product and the competitiveness of the enterprise. Within a sustainable approach, workers can be craftsmen who are able to give to the product the added value that makes it unique and attractive to customers, and at the same time avoid frustration and boredom. Furthermore, the enhancement of craftsmanship in manufacturing often involves technologies that are sustainable so avoiding the type of mass production that generally utilises large amounts of raw materials and consistently produces waste; a mode of production that is not correctly balanced into the environment.

Another important issue is the ethics of production. Workers have to be treated well and justly, with company owners and managers being aware of their needs and rights. A crafts approach, enhancing the characteristics and skills of every

worker, generally fits better with ethical practices, considering and respecting employee satisfaction.

Crafts-industrial production is therefore an interesting paradigm, one that allows the continuance of traditions and the culture of manufacturing activities as they were developed in previous times, but also embraces innovation in order to satisfy the new needs of the market.

3 SLOW FACTORIES

3.1 The slow factory

The term 'Slowness' can have a positive or a negative meaning. Dictionaries define 'slow' as "moving or operating at a low speed or not prompt to understand". Within the industrial realm slowness has always had a negative connotation, a slow production often meant higher costs and less profit, so the idea of slowness as a fundamental factor in the manufacturing of high quality industrial goods is rather new and unusual.

The original idea of **Slowness** is Italian. The first slow "concept" was Slow Food, founded in 1986 as Arcigola by Carlo Petrini in Torino. It started as a protest against the opening of a McDonald's fast food restaurant in Piazza di Spagna in Rome and evolved into a movement against fast life; an attempt to recover good habits of eating and local food traditions. Since then many slow movements have been initiated: Slow Living [8]; Slow Economy [9]; CittàSlow; Slow Technology; etc.; but it's only recently that there has been talk of a Slow Factory.

The first attempt at defining a Slow Factory was made in 2012 by Enzo Baglieri, a professor at Bocconi University in Milano. His manifesto was published on a web blog and indicates three points that must be achieved by a factory in order to be considered "Slow":

1. Awareness of the general context and scenario
2. To import intelligence and to export innovation
3. Responsible management, i.e., ethical practices and good treatment of the workforce.

These three points clearly refer also to sustainability, confirming the idea that the two concepts, sustainability and slowness, are strictly connected. The first point underlines the importance for a manufacturing activity to be integrated in the industrial, commercial and social system, taking into account the evolution of the market but also local culture and habits. Exchanges with other countries must be fostered in terms of importing human resources and export innovative technologies. The ethical issue in the management of a factory and of the labour force is fundamental. Managers must be aware of the workers' conditions and nurture a positive working climate in the plants. This manifesto represents a theoretical approach to the idea of slowness in manufacturing. It is possible to identify some practical applications in some enterprises located in Italy, whose production methods and technologies could suggest them as being examples of slow factories.

3.2 Cases

The current industrial system is generally based on highly automated manufacturing plants, which allow fast production and serial manufacturing. However, some Italian entrepreneurs, using their expertise and know-how, have

decided to recover the value of tradition and craftwork and are finding that slow working processes can produce positive results and add a distinctive value to a product. A significant publication concerning the Italian manufacturing excellences identified as "art professions" is well described in a cultural study by Paolo Colombo [10]. In the following section, we will introduce four different cases where slow manufacturing is in parallel with industrial achievement.

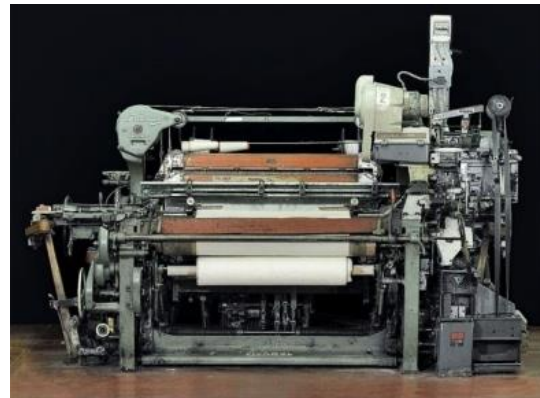


Figure 1: A full mechanical Japanese loom.

In the textile sector Giovanni Bonotto, an entrepreneur whose plants are located in an important industrial district in the north-east of Italy, has chosen to use, together with modern machinery, old Japanese looms which were built in 1957 and can produce high quality non-standardized fabrics (Fig. 1). Bonotto was the first to use the Italian expression "fabbrica lenta" that means "slow factory". In his case, slowness is used in order to communicate a complex approach to textiles production: it corresponds to the use of completely mechanical machinery, eliminating the electronic element, and allowing the workers to act as craftsmen, for whom the loom acts as a tool to quicken the production and not as an automatic system that can substitute them. All weavers are skilled and the standard production that generally characterizes the textile industry is substituted by an industrial-artisan-craftsmanship that allows for the production of unique fabrics. One of the points of strength of a slow mechanical production is the possibility of using and mixing in the same fabric different materials such as cotton, wool, plastics and other fibres. Different threads are woven and compacted together, obtaining beautiful and non-standardized effects. New faster electronic technologies don't give the same possibility of manufacturing as the old full mechanical loom provides. A vastly wide variety of thread materials can be chosen for their different characteristics such as thickness and robustness, and a high-density fabric can be realized; something not possible with an electronic machine, which would struggle with different materials and not be able to press the threads to the correct point.

Giovanni Bonotto controls all the production chain: paying particular attention to the creation of new fabric patterns, dyeing techniques and especially to raw materials. By testing innovative solutions, always enhancing the cultural heritage in the product and controlling the whole supply chain, the final possible imperfections of the fabrics - due to manual weaving

or imperfections in the raw and natural materials - also become an unexpected point of attraction to customers. All this care and attention needs time and doesn't fit with the common standard methods of production. A phrase can represent the Bonotto company philosophy: "Time is the new luxury".

Pagani Automobili S.p.A. was founded by Horacio Pagani and proposes a number of versions of the Zonda model, a supercar designed in the '90s and realised using the most advanced technologies and materials but with the employment of exclusively artisanal skills in their workshop near Modena. Pagani came to Italy with a great passion for cars, having studied and gained a wealth of experience in Argentina. Following important collaborations with some of the most famous industries in Italy in the automotive field, he began the construction of his own product. Pagani's suppliers and partners are important industry brands, well known for their technological leadership. Recently, Pagani introduced its new project, the Huayra, which is considered today to be the fastest supercar. It is made of more than 4000 components, excluding the engine and the gearbox, and is designed, manufactured and assembled combining science, technology and art in a fully artisanal way.

The Pagani's design team develops the car design and skilled craftsmen manually assemble the thousands of components into the final product, without exploiting any of the automatic processes commonly used in car manufacturing plants. Despite new and advanced technologies and materials, manufacturing is still implemented as in a traditional Italian "bottega" (workshop and retail outlet).

Other significant examples of slow production are present in the Italian food sector. We have in particular examined some olive oil mills located close to Assisi, "Le Mandrie", and the medium-sized family enterprise "Babbi" which is near Cesena, accompany famous all over the world for wafers, sweets and creams. They both apply the concepts of slowness but in different ways. The idea is always to confer uniqueness to the product and to distinguish it from industrial and mass production.

Le Mandrie uses innovative machinery and equipment specifically designed with the most modern technologies to extract oil from olives (Fig. 2). The olive oil mills were designed and developed by the owners together with one of the most acknowledged producers of olive oil extraction plants, by exploiting specific knowledge gained from a long tradition in this field. In order to preserve nutritional content and maintain the special scent and flavour, it is necessary to avoid high temperatures during the chipping of the olives. For this reason, the mill works at a low speed with an enforced slowness that allows the highest quality olive oil to be obtained.

The core of the process was designed in order to achieve the best results from a natural high quality product cultivated in the hills near Assisi. The modern structure of the plant also allows for a more industrial production, using maximum capacity and velocity but, in this case, the final results will be different in taste and organoleptic effect. The main technical characteristic of the cold press extraction process for extra virgin oils, as realized in Le Mandrie shop, is that the extraction is based only on physical and mechanical principles. To cite some of the more peculiar aspects: the steel drums work slowly and the drupes together with the

stones are divided into several parts; during this grinding process the produced fumes are suctioned; the following stage in the kneading machine is again slow because it doesn't use heat - which speeds up the process but reduces the flavour and nutritional content; during the extraction in the horizontal centrifuge or decanter a hot water process is avoided and only a small amount of cold water is added, thus maximising the organoleptic effect and preserving natural elements.



Figure 2: A modern innovative olive oil extraction plant.

A different idea of slowness is implemented at Babbi. In the production plant there is a mixture of old and modern machineries depending on the type of process. For example, candied figs, one of the Babbi's main products, need to be boiled for seven hours in a cauldron with a burner underneath (Fig. 3). The company has experimented with the process utilising new and modern machines already present and used for other purposes; in particular pasteurization was tested in order to increase production time and save money but the final product didn't taste the same. The old process is the only one that guarantees the uniqueness of this product.



Figure 3: Cauldron for cooking candied figs.

3.3 Classification of slow manufacturing

The above-mentioned practical cases can generate a classification of slow manufacturing approaches that can be useful in understanding this phenomenon. Slowness can be implemented in different ways in terms of technologies and production machineries or methods of production. Depending on the kind of product and specific aims, different enterprises choose what is most suitable for them.

Machine/ Technology	Speed	Notes	Industrial Reference
OLD	SLOW	Old machines working at their fastest speed, considered slow by modern standards	Bonotto
NEW	SLOW	All the manufacture is manually made by skilled craftsmen	Pagani
NEW	SLOW	A slow speed is forced on modern machinery that could operate faster	Le Mandrie
OLD and NEW	SLOW and FAST	Both machinery and related speed are used depending on the products	Babbi

Table 1: Slow manufacturing classification

4 CONCLUSIONS

4.1 Present situation

A sustainable production means not only saving energy and reducing waste but also the quality of the workers' lives is important, along with the possibility for them to express their capabilities and skills. A recovery of tradition and old ways of manufacturing is therefore sought in order to improve work conditions but also to endow the product with an extra value that cannot be achieved through modern processes and technologies.

This is particularly true for food production, where only time-honoured methodologies can produce the desired results and taste, but is also relevant in other industrial sectors such as textiles.

The beneficial outcome of slow products has been confirmed with the general increase in the turnover of slow factories in recent years. The international success of "Eataly", a Made in Italy foods distribution network, demonstrates that customers appreciate food and drinks manufactured in traditional slow ways and are prepared to pay a little extra for them, as long as their high quality is guaranteed.

A classification of these slow approaches has been made, identifying four ways of implementing slowness in manufacturing based on the choice of old or modern machinery and on the speed of production.

In present times, when the low costs of labour in developing countries has made it competitively difficult in Europe, some Italian entrepreneurs have adopted one or a combination of these approaches to offer a unique product and increase market shares.

4.2 Future developments

Further research is required in order to expand the analysis of slowness in manufacturing across a range of industrial fields and enterprises. Additional categories could be identified, denoting new and different approaches. The slow factory is still a new and challenging topic, particularly significant nowadays in the search to find new paradigms of production that assist industries in selling more and better products to a wider variety of customers.

The relations of the slow factory paradigm to sustainability are also significant and merit being deepened in technical and sociological terms.

5 ACKNOWLEDGMENTS

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